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MASSACHUSETTS COASTAL STREAMS

Public Health Service
Boston, Massachusetts

1952

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Department of Public Health
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CLARENCE I. STERLING, JR.
Director
Division of Sanitary Engineering

511A

July 31, 1952

Mr. Leonard W. Trager
Officer in Charge
Northeast Drainage Basins Office
Public Health Service
120 Boylston Street
Boston 16, Massachusetts

Dear Sir:

The Division of Sanitary Engineering has reviewed the "Report on Water Pollution, Massachusetts Coastal Streams Basin". In the opinion of the Division, the data are accurate and complete.

The contents are set forth in such a manner that it may be separated readily for use by sub-basins. This feature should assist materially in bringing the needs of sewerage and sewage and industrial waste treatment to the attention of municipalities and persons in the area.

The Division hereby approves this report.

Very truly yours,

(Signed) C. I. STERLING, JR.

Clarence I. Sterling, Jr.
Chief Sanitary Engineer

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REPORT ON WATER POLLUTION

Massachusetts Coastal Streams

prepared by

FEDERAL SECURITY AGENCY
PUBLIC HEALTH SERVICE
Division of Water Pollution Control
Northeast Drainage Basins Office

1952

in cooperation with

Commonwealth of Massachusetts
Department of Public Health

2-a

TABLE OF CONTENTS

Part I

	PAGE
Section 1 - Introduction	1
Section 2 - Acknowledgements	3
Section 3 - Summary	5
Section 4 - Conclusions	25
Section 5 - Recommendations	27
Section 6 - Physical Description	29
Section 7 - Economic Development	34
Section 8 - Uses of Water Resources	44
Section 9 - Pollution Contributed to Water Resources	54
Section 10 - Damages to Water Resources from Pollution	71
Section 11 - Benefits Resulting from Pollution Prevention and Abatement	86
Section 12 - Pollution Prevention Measures in Effect	91
Section 13 - Pollution Prevention Measures Required	104

MAPS

Figure A - Cities and Towns Served by Metropolitan District and Boston Sewers ..... Follows	55
Map 1 - General Map of Massachusetts Coastal Streams Basin ..... Follows	33
Map 2 - Map of Existing Primary Water Uses ..... Follows	44
Map 3 - Sources of Pollution and Existing Treatment Facilities ..... Follows	55
Map 4 - Present Stream Water Conditions ..... Follows	77
Map 5 - Projects Required ..... Follows	114

TABLES

PAGE

Table A - Sources of Pollution—Municipal.................... 11

Table B - Sources of Pollution—Industrial.................... 12

Table C - Existing Treatment Facilities—Municipal............ 13

Table D - Existing Treatment Facilities—Industrial........... 14

Table E - Adequacy of Existing Treatment Facilities—Municipal 16

Table F - Adequacy of Existing Treatment Facilities—Industrial.. 17

Table G - Progress in Construction of Pollution Abatement Facilities.. 18

Table H - Waste Treatment Needs—Municipal.................... 20

Table I - Industrial Waste Pollution Abatement Needs.......... 20

Table J - Current Status of Municipal Action on Pollution Abatement Needs.................................... 21

Table K - Current Status of Industrial Action on Pollution Abatement Needs.................................... 22

Table 1 - Stream Gaging Data, Massachusetts Coastal Streams Basin.. 31

Table 2 - Estimated Increases in Manufacturing Growth, Employment and Income from 1939 through 1947.............. 36

Table 3 - General Statistics on Manufacturing Employment and Income in 1947.. 37

Table 4 - Data on Farm Size, Value and Income................. 38

Table 5 - Summary of Number and Status of Known Sources of Pollution.. 56

Table 6 - Known Sources of Municipal Sewage Pollution......... 60

Table 7 - Sources of Institutional Sewage Pollution........... 65

Table 8 - Sources of Industrial Wastes and Sewage Pollution... 67

Table 9 - Damages to Quality of Water Resources Resulting from Pollution.. 73

Table 10 - Census of Municipal Sewage Treatment Plants........ 93

TABLES - continued

PAGE

Table 11 - Census of Municipal Ocean Outfall Sewers.......... 94

Table 12 - Census of Institutional Sewage Treatment Plants... 96

Table 13 - Census of Industrial Waste Treatment Facilities... 98

Table 14 - Municipalities and Industries Needing Improvements for Abatement of Pollution—February 1952......... 108

Part II

Introduction.. 117

Section .1 - The North Shore Sub-basin...................... 118

Section .2 - The Ipswich River Sub-basin.................... 123

Section .3 - The Danvers River and Salem-Beverly Harbors Sub-basin.................................... 128

Section .4 - The Mystic River Sub-basin..................... 133

Section .5 - The Charles River Sub-basin.................... 139

Section .6 - The Neponset River Sub-basin................... 147

Section .7 - The Boston Harbor Sub-basin.................... 152

Section .8 - The North River Sub-basin...................... 161

Section .9 - The South Shore Sub-basin...................... 168

Section .10 - The Buzzards Bay Sub-basin.................... 175

Section .11 - The Cape Cod Sub-basin........................ 181

Section .12 - The Islands Sub-basin......................... 188

MAPS

Map 6 - Sub-basin..................................Follows 117

BASIC DATA TABLES ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION

PAGE

Table A1 - The North Shore Sub-basin.......................... 122

Table A2 - The Ipswich River Sub-basin........................ 127

Table A3 - The Danvers River and Salem-Beverly Harbors Sub-basin.. 132

Table A4 - The Mystic River Sub-basin......................... 138

Table A5 - The Charles River Sub-basin........................ 145

Table A6 - The Neponset River Sub-basin....................... 151

Table A7 - The Boston Harbor Sub-basin........................ 159

Table A8 - The North River Sub-basin.......................... 166

Table A9 - The South Shore Sub-basin.......................... 173

Table A10 - The Buzzards Bay Sub-basin........................ 180

Table A11 - The Cape Cod Sub-basin............................ 186

Table A12 - The Islands Sub-basin............................. 191

APPENDIX

Appendix "A" - Basic Data on Sources of Municipal Pollution... i

Appendix "B" - Basic Data on Sources of Industrial Pollution.. xiii

Appendix "C" - 1940 and 1950 Populations of Cities and Towns.. xxiii

Appendix "D" - Census of Public Water Supplies................. xxvii

Appendix "E" - Census of Institutions Served by Water Supplies.. xxxvi

Appendix "F" - Synopsis of State and Interstate Legislation in Effect...xxxvii

6-2

Part I

REPORT ON WATER POLLUTION

MASSACHUSETTS COASTAL STREAMS BASIN

1952

7-a

Section I

INTRODUCTION

The Federal Water Pollution Control Act, Public Law 845, passed by the 80th Congress in June 1948, requires the Surgeon General of the Public Health Service to cooperate with other Federal agencies, with State and interstate water pollution control agencies and with municipalities and industries in the preparation or adoption of comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof, and improving the sanitary condition of surface and underground waters.

In developing these programs, due regard must be given to improvements necessary to conserve the Nation's waters for public water supplies, propagation of fish and aquatic life, recreational purposes, agricultural, and other legitimate uses.

Recognizing the fact that full technical information was not available to permit the development of such comprehensive programs immediately for most of the Nation's waters, the Public Health Service envisioned the development of a series of reports to cover the interim period prior to the development of comprehensive water pollution control programs. The first of these reports were the Summary Reports which were prepared for the 15 major drainage basins of the country on the basis of information readily available as of July 1, 1950. The second group of reports of this series, of which this is one, are reports on several sub-basins of the country's major drainage basin areas. Since development of comprehensive water pollution control programs is to proceed as rapidly as conditions permit, only a limited number of these interim sub-basin reports are to be completed, and the majority of these will be for interstate sub-basin areas. These reports are based on available data and will provide a reference point for measuring progress; provide a guide to needed additional data; provide a basis for the logical development of comprehensive programs; and serve to inform the public on the water pollution control problem and needs for the sub-basin concerned.

This sub-basin report is based on data available as of February 1952 and has been compiled through and in cooperation with the State Department of Public Health, but these data should not be considered the final detailed engineering investigation of the Massachusetts Coastal Streams Basin. Through this cooperating agency, additional data have been obtained from other State officials, county and city officials and representatives of industry. Federal agencies also have been of great assistance.

The sub-basin reports present information about the ways the water resources of the area are used, the pollution entering those water resources and the resulting damages, the benefits which may result from pollution prevention and abatement, pollution prevention measures now in effect, and those which appear to be needed.

Since the Massachusetts Department of Public Health has not yet classified the streams in this sub-basin for future best uses of these waters, there is no discussion of such uses as related to pollution control. Such considerations will be included as a part of the comprehensive water pollution program which will be developed later.

Data and knowledge now available are sufficient, however, to permit the immediate solution of many of the pollution problems within the Massachusetts Coastal Streams Basin without awaiting the results of additional surveys and studies that may be shown to be required.

A sincere effort has been made by all who contributed to this report to present a fair picture of the complex water pollution problems in the Massachusetts Coastal Streams Basin and to present reasonable conclusions and recommendations. It is our hope that this report, as a step in the cooperative development of an ultimate comprehensive water pollution control program, will help in safeguarding the water resources of the Massachusetts Coastal Streams Basin.

Section 2

ACKNOWLEDGMENTS

Special acknowledgment is made of the contributions to this report by the special water pollution control agencies concerned in the Massachusetts Coastal Streams Basin. The cooperation extended was excellent and the information and data requested were helpfully and willingly supplied. It is desired to acknowledge in particular the assistance given by the following:

Massachusetts Department of Public Health
Division of Sanitary Engineering

Clarence I. Sterling, Jr., Chief Engineer
Worthen H. Taylor, Senior Sanitary Engineer

Metropolitan District Commission

Thomas A. Berrigan,
Director and Chief Engineer, Sewerage Division
Harold J. Toole,
Director and Chief Engineer, Water Division

The compilation of data and information required in support of this document has been a project of considerable magnitude. The cooperation and assistance of the following agencies are also gratefully acknowledged.

Massachusetts

Department of Conservation
    Division of Marine Fisheries
    Division of Parks and Recreation

Development and Industrial Commission

Metropolitan District Commission
    Parks Division

New England

New England Council — Boston, Mass.

Federal

U. S. Department of Interior
    Geological Survey — Boston, Mass.

Federal (Cont.)

U. S. Department of Commerce	
Bureau of Census	Boston, Mass.
Weather Bureau	Boston, Mass.
U. S. Department of Agriculture	Boston, Mass.
Department of the Army	
Corps of Engineers, New England Division	Boston, Mass.
Federal Power Commission	New York, N.Y.
Atlantic States Marine Fisheries Commission	Mt. Vernon, N.Y.

SUMMARY

The watershed of the Massachusetts Coastal Streams Basin is comprised of almost the entire area in Massachusetts draining into the Atlantic Ocean. A very small area in the extreme north, drained by the Merrimack and Blackwater Rivers, is the only coastal area in the State excluded.

Including the islands, the basin is fronted by more than 2,000 miles of coastline, most of which has been developed for recreation. The watershed extends inland for a maximum distance of about 30 miles and a minimum distance of about five miles, averaging a depth of some 22 miles. The distance along the north-south major axis on the mainland is nearly 90 miles. The watersheds of more than 21 small streams make up this coastal basin, the total area being approximately 2,150 square miles.

About half of the basin is covered by woodland of little value and about 13 percent of the land is in farms. Nearly one-third of the basin has been classified as urban and is heavily populated and highly industralized.

The basin lies along a coastal lowland that contains considerable areas of swampy or poorly drained land and numerous small ponds. The highest elevations are encountered in the lenticular hills near Boston which range in altitudes from 100 to 200 feet above mean sea level.

The geological bedrock formation is largely granite that outcrops frequently. The overburden is composed principally of glacial deposits of sand and gravel. Cape Cod is a terminal moraine covered by a thin topsoil.

The basin is influenced by air masses that produce alternate low and high pressure atmospheric conditions and frequent weather changes. The climate is temperate and the basin is seldom subjected to prolonged periods of either high or low temperatures. Summer temperatures average about 68° F. and winter temperatures average some 28° F. The average annual precipitation amounts to about 42 inches, of which less than 10 percent is accountable as snowfall.

The principal streams draining the basin are the Ipswich, Charles and Neponset Rivers with respective watersheds of about 150, 200 and 170 square miles. These figures have been corrected for diversions made. The average annual run-off per square mile is approximately 1.60 cubic feet per second and the run-off from the approximately 2,150 square miles in the basin is computed to be 3,400 cubic feet per second or approximately 2,200 million gallons per day.

Compared with other river basins in New England the average fall and velocity of streams in this coastal basin are low. Most meander sluggishly through comparatively long stretches of low agricultural or marsh land. The rivers are not generally subject to floods but where local flooding does occur, it could be remedied by channel improvements and construction of dikes. The extensive marshy areas bordering streams act as natural flood control reservoirs.

Manufacturing activities provide the economic core of the area and the Boston metropolitan area is one of the country's largest standard metropolitan areas (contains 40,000 or more manufacturing employees) as defined by the Bureau of the Census. The basin also includes the New Bedford portion of the Fall River-New Bedford standard metropolitan area. Manufacturing is rather well diversified but there are a few cities where some specialization is still practiced. The basin contains less than one-fourth the land area of Massachusetts but contains more than half of all the manufacturing establishments in the State. These plants employ about 44 percent of all manufacturing employees. Industry has shown a steady growth in the basin and during the period 1939-1947 the number of manufacturing plants increased by 16 percent, the number of production workers increased by 52.6 percent, and the value added to products by manufacture increased by 160 percent. The value added to all products by manufacture in 1947 was an estimated $1,560,000,000.

The principal products manufactured are foods, textiles, apparel, paper and allied goods, chemicals, leather and allied commodities, fabricated metal, machinery and electrical goods.

The amount of area given over to farming is small but agriculture is intensive where practiced. Farming is directed primarily into the fields of dairying, poultry-raising, fruit-growing and truck gardening. Large areas in Plymouth and Barnstable counties are given over to cranberry bogs which annually produce about two-thirds or more of the nation's crop. The value of all crops sold on farms in 1949 was approximately $31,000,000. The basin contains only 14 percent of the cleared farmland in the State and yet it accounts for nearly 30 percent of the value of all farm products sold from farms in the Commonwealth.

Recreation is an important industry in the Massachusetts Coastal Streams Basin. The basin is fronted by more than 2,000 miles of shoreline, most of which has been developed for recreation, either public or private. The area contains one of the nation's ten largest metropolitan populations and is annually invaded by thousands of visitors and vacationists. The Cape Cod and Buzzards Bay areas are two of the best-known recreation areas in the country and the value of the lands developed for recreation there is probably unequalled by any other area of equal size in America. The value of all lands in the basin suitable for recreation is unusually high.

Most of the recreational development has been by private capital and the investments in amusement parks, resort hotels, summer estates and homes, cabins, bathing beaches, yacht clubs, golf clubs, riding academies, fishing craft, etc., are tremendous. There has also been a large investment of public funds in recreational development by the State, cities and towns. Despite the considerable development of public recreational facilities, it is generally agreed among public officials that many more public facilities are needed, particularly in the Boston metropolitan area. The greatest need is for public bathing areas for day-use by the residents of this highly populated urban center.

Recreation is important to the regional economy and the private and public development of this industry is being encouraged by both public and private agencies. The present average annual income from the recreation industry is not accurately known but is estimated that it may approach $20,000,000.

Although half of the watershed is covered by woodland, very little is marketable. The income from all forest products sold in 1945 is estimated to have been only $135,000, most from the sale of cordwood.

The only mining or quarrying of any consequence is the quarrying of granite at Quincy and Rockport. The output from these two sources exceeds the total output of any other New England State.

Boston is one of the principal fishing ports in the United States, and there are other important fishing ports in the basin. There were 523,000,000 pounds of fish landed at Massachusetts ports in 1950 and the value of these catches was over $36,500,000. This does not include the value of lobsters, clams and quahaugs taken from the coastal waters which amounts to more than a million dollars annually.

The population of the basin has shown a steady increase. The 1930 population was estimated to be 2,250,000; in 1940 the population was approximately 2,456,000; and from advance reports of the 1950 census, the population was computed to be 2,671,000. The preliminary census figure would indicate a population density of 1,235 persons per square mile in 1950.

There are 57 urban cities and towns in the basin of which five are partly in adjoining watersheds. Persons living in urban areas account for approximately 93 percent of the total basin population, about 5 percent reside in villages in non-urban towns and the farm population accounts for a little less than 2 percent of the total population. Boston is the largest city, being one of the ten largest cities in the United States, and the 1950 population was reported to be 801,444. Cambridge is the second largest city with a 1950 population of 120,740 and there are two other cities with populations over 100,000.

The income of residents is not accurately known. In 1947, the average income per manufacturing employee was about $2,700 per year and today it is probably nearer $3,100. Since statistics generally show an average of more than one employee per family in the manufacturing cities, the average annual buying power income per family is probably between $4,500 and $5,000 per year. The average income per farm, which should approximate farm family income, was $4,300 per year in 1945 and has since probably risen to more than $5,000. The incomes of the self-employed and of the service and professional groups are not available. The 1950 Dun and Bradstreet reference book lists per capita income for Massachusetts at $1,417. On this basis it is estimated that the average family income was near $5,000 in 1950. This indicates that the average family income in the basin is higher than the average for the United States.

Compared to other river basins, the fresh-water resources of the small coastal streams in this basin are rather limited. The basin contains a large population and a highly-developed manufacturing economy. The demands on the water resources have been increasing steadily and there is a considerable use of them for all normal purposes. Some of the water uses being made, or desired to be made, are in conflict with other uses. The basin has extensive salt-water resources in the coastal waters and these are probably the most economically important water resources available. The uses of the water resources are for public water supply, industrial water supply, livestock watering, game fishing, recreational bathing, boating and yachting, navigation, hydro-electric power development, commercial fishing, shellfish propagation, wildlife habitat and transportation of sewage and industrial wastes.

There are 131 communities served by 79 water supply systems. Approximately 2,603,100 persons, or about 95 percent of the total population, are served by public water utilities. Included are populations of Brockton and Pembroke served by Silver Lake but otherwise not counted in the basin. Twenty-five surface water supplies have been developed from the water resources of the basin and these supply 724,960 persons. Watersheds outside the basin serve about 1,510,000 persons residing in the basin. Ground waters have been developed as the principal source of supply for 54 systems that serve 367,310 persons. The total daily public water supply consumption is approximately 293,326,000 gallons of which 181,940,000 gallons are supplied from sources outside the basin. Surface waters account for 257,335,000 gallons per day of the water distributed and ground waters furnish the remaining 36,932,000 gallons per day. All public water supply watersheds except portions of the Ipswich River Basin are protected from pollution and all public water supplies are subject to sanitary inspection and analysis by the State Department of Public Health through its Division of Sanitary Engineering. There are several areas of critical public water supply shortage.

The use of the basin's water resources for industrial purposes is second in importance only to the use for public water supply. A recently completed water use field survey indicates that the total process water use by industry from all sources averages at least 113 million gallons daily. Of this amount, it is estimated that 82.5 million gallons are purchased from public systems, 19.5 million gallons are taken from available streams and ponds, seven million gallons are derived from industrial wells, and four million gallons from salt water. In addition, a large volume of salt water, estimated to be in excess of 600 million gallons per day, is used by power plants, other manufacturing plants, and by seafood processing establishments.

Recreational use of the water resources has long been one of the most important and extensive water uses made in this basin. There has been extensive development for recreational bathing, game fishing and boating and yachting. The water resources not only sustain an economically important recreation industry but are needed as a recreational outlet for a large, permanent population. Pollution creates the greatest conflict with the recreational use and development of the water resources.

The importance of livestock and livestock products to farm incomes indicates that an adequate water supply for farm animals is important. There is also some irrigation practice in the basin but the water supply for this purpose is mainly taken from wells.

Commercial fishing is of considerable economic significance to the area but most of the important fishing banks lie off the Massachusetts coast. There is some commercial fishing in the coastal waters, however. The importance of the coastal waters to commercial fishing is mainly in the shore installations, shipbuilding and harborage required to support this industry. The clam and lobster yields are important products of the coastal waters and their sale in 1950 netted an income of more than $1,150,000.

Navigation is an important use of the coastal waters. The Port of Boston is one of the more important major ports along the Atlantic seaboard. The freight traffic in Boston Harbor in 1950 was 18,194,438 net tons of shipping. Ocean-going ships listed a total of 35,828 passengers. Ferry services in the harbor and coastwise steamers accounted for 2,102,696 passengers.

There is little use of the water resources for hydro-electric power development as the streams in the basin are not well-suited to this purpose. There are three industrial and three utility hydroelectric plants in operation having a total installed capacity of 1,522 kilowatts. Total generation in 1949 was 1,633,500 kilowatt hours.

There is a large use of the streams and tidal waters for the transportation of sewage and industrial wastes. While the use of the water resources as the place of final disposal for sewage and industrial wastes is indispensable, the practice has resulted in serious conflict with most of the other normal and desired water uses. Measures are needed to conserve the quality of the water resources to permit the harmonious accommodation of the principal water uses.

There are 13 separate watersheds receiving pollution within their systems that have main stems and principal tributaries totaling a watercourse length of about 257 miles. Of the watercourse miles within those watersheds, 138 miles receive only minor or no pollution and the waters are of good bacteriological and chemical quality, suitable for all legitimate purposes except public water supply without filtration and disinfection; 63 miles are polluted sufficiently to render the waters unsuitable for public water supply except with adequate filtration and disinfection, for recreational uses except boating, for some industrial processes without treatment, for irrigation of crops consumed without cooking and these waters may not always be of good aesthetic quality; about 29 miles are rather seriously damaged by pollution and suitable only for transportation of wastes, power development and limited industrial purposes; and the remaining 31 miles are seriously damaged and are in nuisance condition, not suitable for any legitimate purpose except power development. In addition, the pollution of coastal waters has caused the closing of hundreds of acres of clam flats all along the coast.

The water resources are subjected to large volumes of sewage and industrial wastes but the number of sources of pollution is comparatively small. The North Metropolitan Sewerage District, the South Metropolitan Sewerage District and the Boston Main Drainage System serve 1,806,000 persons and a large number of industries in 33 cities and towns. These three sewerage systems represent only three sources of pollution, exclusive of sewage overflows into streams which occur with regularity at about eight points. The South Essex Sewerage District serves four municipalities with a total connected population of 84,400, yet accounts for only one source of pollution. A large number of towns have no municipal sewerage systems but residents satisfactorily treat domestic wastes in individual treatment units. This method of individual sewage disposal explains in part why there are comparatively few sources of sewage pollution in a basin where 131 communities are served by public water supplies.

There are 63 separate sources of municipal and institutional sewage pollution from the discharge of untreated sewage and sewage plant effluents. There are more than 2,200,000 persons residing in 78 cities and towns, including 17 institutions, contributing to these 63 separate sources of sewage pollution. The total pollutional load discharged to watercourses by municipal and institutional sewage is computed to be equivalent to the domestic wastes from approximately 3,982,000 persons. Table A summarizes the data on sources of municipal and institutional sewage pollution.

TABLE A

SOURCES OF POLLUTION

MUNICIPAL

Municipalities*	Sources of Pollution (In Number of Municipalities*)	Population Served by Sewerage System	Amount of Pollution Discharged to Watercourse (In Terms of Equivalent Number of People)**
Having data on pollution load discharged to watercourse	63 1/	2,207,940 2/	3,982,790 2/
Having population data available (Data on pollution load to watercourse incomplete or not available)	None	None	Undetermined
Total	63	2,207,940 2/	3,982,790 2/

* Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers or other population centers.

** Includes industrial wastes discharged into municipal sewerage systems.

1/ Sources of pollution are contributed to by 77 cities and towns, including 17 institutions which have a combined total of 63 outlets discharging directly to watercourses.

2/ Includes 8,690 persons served by private sewers and 9,360 persons residing in institutions. Does not include population figures for two military establishments which are withheld.

The streams in the basin receive pollution from a total of 46 separate sources from industrial plants. This does not include industrial wastes connected to municipal sewerage systems. The sources of pollution from industry include 21 untreated process wastes, effluents from 23 industrial waste treatment facilities and sanitary sewage from two plants producing no process wastes. Some of the plants discharging process wastes also discharge employee sewage but these are counted as having only one source of industrial pollution. The total pollutional load contributed by separate sources of industrial pollution is computed from available data to be equivalent to the domestic wastes of more than 73,000 persons. A summary of industrial sources of pollution is presented in Table B.

TABLE B

SOURCES OF POLLUTION

INDUSTRIAL*

Industries*	Sources of Pollution (In Number of Plants)	Amount of Pollution Discharged to Watercourse (In Terms of Equivalent Number of People)
Producing Organic Wastes	28 1/	73,700
Producing Organic Wastes	5 2/	Undetermined
Producing Inorganic Wastes	13	Not Applicable
Producing Wastes of Undetermined Type		Undetermined
Total	46	xxxxxx

* Industries having separate outlets discharging wastes directly to watercourse.

1/ Includes two plants having employee sewage only.

2/ All are seasonal fish processing plants where information is not yet available.

For the total of 63 separate discharges of municipal and institutional sewage pollution in the basin, there have been 29 sewage treatment plants placed in operation. In addition there are two municipalities and two institutions having sewage treatment plants that cause no stream pollution since effluents are disposed of by sub-surface drainage. These 33 sewage treatment facilities serve a total of nearly 678,000 persons in 14 communities, 10 institutions, four schools, two colleges and three military bases. The populations served by facilities at military establishments are not given. All of the treatment plants in operation provide secondary treatment except the Nut Island primary treatment plant of the South Metropolitan Sewerage District which serves 640,890 persons.

The sewage from 34 sources of municipal sewage pollution contributed to by 44 municipalities is discharged to streams and coastal waters with minor or no treatment. Five of these last, however, have satisfactory disposal at four ocean outfall sewers that serve 131,400 persons.

Table C is a summation of the basic data available on existing treatment facilities serving municipalities and institutions.

TABLE C

EXISTING TREATMENT FACILITIES

MUNICIPAL

Degree of Treatment Provided	Number of Municipalities* Served	Number of Treatment Plants	Population Served
Primary	16 1/	1	640,890
Secondary	32 2/ 3/	31	38,910 3/
No Treatment	46 4/		1,541,440 5/

* Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers or other population centers.

1/ The Nut Island plant of South Metropolitan Sewerage District serves 15 communities and part of Boston.

2/ Includes 18 institutions located in 14 towns; 2 municipalities each having 2 plants and each serving 2 communities; and 9 municipalities served by 1 plant each, all units served counted as municipalities. The total number of towns containing these 31 plants is 25.

3/ Includes 2 municipal and 2 institutional plants with effluents discharged to ground water, not elsewhere counted as sources of pollution. Does not include population figures for 3 military bases.

4/ Actual separate sources of pollution from 46 different municipalities total 34—four outfall sewers serve 26 separate municipalities; four other municipalities have a total of 9 separate sources; 16 additional municipalities have one source each; and five of the municipalities already counted under outfall sewers have one other separate source each.

5/ Includes 131,400 persons in five communities served by satisfactory ocean outfall sewers.

Twenty-three industrial establishments having separate outlets discharging directly to watercourses have provided treatment facilities for process wastes. One manufacturing plant that produces no process wastes has provided treatment facilities for employee sewage. In addition, there are four industrial waste treatment plants in operation that discharge effluents to sub-surface drainage areas, not causing pollution and not elsewhere in this report counted as sources of pollution.

Twenty-one produce process wastes having a population equivalent of about 17,000 persons for which no treatment has been provided. One plant discharging sanitary sewage only disposes of these wastes untreated.

Table D presents a breakdown of separate sources of process wastes receiving treatment and major industry groups are shown.

TABLE D

EXISTING TREATMENT FACILITIES

INDUSTRIAL*

Type Industry	Number of Plants	Number of Industrial Plants Having: Treatment Facilities	No Treatment Facilities	Undetermined Facilities
Food, etc.	10	5	5	—
Textile, etc.	9	3	6	—
Paper, etc.	2	1	1	—

TABLE D

EXISTING TREATMENT FACILITIES

INDUSTRIAL* (Cont.)

Type Industry	Number of Plants	Number of Industrial Plants Having: Treatment Facilities	No Treatment Facilities	Undetermined Facilities
Chemicals, etc.	4	2	2	—
Petroleum, etc.	6	5	1	—
Rubber, etc.	2	1	1	—
Leather, etc.	3	3	0	—
Primary, etc.	1	0	1	—
Fabricated, etc.	3	1	2	—
Miscellaneous	8	5	3	—
Plants Discharging Sanitary Sewage Only	2	1	1	—
Totals	50 1/	27 1/	23	—

* Industries having separate outlets discharging wastes directly to watercourse.

1/ Include four industrial waste treatment facilities with effluents discharging to ground water, not causing pollution and not elsewhere counted as such in this report.

Of the 33 existing sewage treatment plants operated by 14 municipalities, 10 institutions, four schools, two colleges and three military establishments, all are satisfactory in capacity and operation except four municipal plants. There are three institutional plants, however, that are satisfactory in all respects except that chlorination of secondary effluents is required to safeguard water qualities for downstream users.

The sewage from more than 675,000 persons is adequately treated, the sewage from nearly 3,100 persons is adequately treated biologically but effluents require chlorination before treatment is wholly adequate, and only the sewage from four plants serving 4,875 persons is unsatisfactorily treated.

The adequacy of existing municipal and institutional sewage treatment facilities with relation to capacity and operation is shown in Table E.

TABLE E

ADEQUACY OF EXISTING TREATMENT FACILITIES

MUNICIPAL*

Number of Municipal* Treatment Facilities	Adequacy with Relation to:					
	Capacity			Operation		
	Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
32 1/	29 2/	4		29	3	

* Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers or other population centers.

1/ Does not include Provincetown with community project completed for individual treatment of sewage pollution but does not operate a municipal sewage treatment plant.

2/ Includes three institutions requiring chlorination only.

Twenty-three industrial plants having separate outlets discharging process wastes directly to watercourses have provided treatment facilities as has one plant discharging sanitary sewage only. Seven of the industrial waste treatment plants are satisfactory in capacity and operation. Sixteen plants treating process wastes and the one treating sewage are of inadequate capacity although the operation of eight of these facilities is satisfactory.

The status of capacity and operation of the existing treatment facilities provided by industrial plants is given in Table F.

During the period 1947 to date, a total of ten municipal sewage projects and two institutional sewage projects were completed. Only one of these projects was for the construction of a sewage treatment plant, this being the Nut Island plant of the South Metropolitan Sewerage District. One project was to install a grit and grease removal chamber preceding an ocean outfall sewer; one project was the installation of about 250 cesspools and leaching fields to serve approximately 1,000 persons in one municipality; two projects were by one community which in 1949 installed a comminutor on the outfall sewer and which in 1950 constructed a new ocean outfall sewer; one municipality constructed intercepting sewers with connection to ocean outfall; one municipality installed screening equipment preceding disposal of sewage at an ocean outfall sewer and extension of sewerage system; one municipality which constructed a sewerage system with ocean outfall sewer; one hospital constructed additions to an existing sewage treatment plant; and two municipalities and one institution installed chlorinating equipment.

From 1947 to the present, there have been 19 treatment facilities placed in operation by industrial establishments, 15 for the treatment of process wastes and four for treatment of employee sewage.

The State Department of Public Health is handicapped in carrying out comprehensive water pollution control activities through a lack of technical personnel and insufficient funds for necessary surveys, studies, investigations, education of the public and community planning projects. Pollution abatement programs are generally caused to be carried out over extended periods during which time it is difficult to maintain the necessary interest and cooperation of the public and industry. The rising costs of living and of doing business, and the pressure of other municipal needs, have increased the reluctance of communities and industries towards expending funds for needed pollution abatement measures. The Department makes considerable effort to devise and recommend treatment measures that are reasonable and equitable, however, and has concluded that most measures can be provided without undue financial hardship.

Table G shows the progress in construction of pollution prevention and abatement facilities during the period 1947 to the present. Not shown are many connections to municipal sewerage systems of industrial process wastes that have been made, some of which required construction of pre-treatment devices. The list of these industries is not readily available but credit for the elimination of these sources of pollution should be given to the Department and to the individual companies.

TABLE F

ADEQUACY OF EXISTING TREATMENT FACILITIES

INDUSTRIAL*

Number of Industrial* Treatment Facilities	Adequacy with Relation to:					
	Capacity			Operation		
	Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
24	7	17 1/	0	16	8	0

* Industries having separate outlets discharging wastes directly to watercourse.

1/ Includes one plant having sanitary wastes only.

TABLE G

PROGRESS IN CONSTRUCTION OF POLLUTION ABATEMENT FACILITIES

Year	Municipal		Industrial	
	Sewage Treatment Plants Completed	Design Population	Waste Treatment Plants Completed	Amount of Waste Treated (In Terms of Equiv. No. People)
1947	1 1/	19,700	—	—
1948	—	—	1 5/	108
1949	2 2/	15,600	2	20,500
1950	5 3/	N	4 6/	15,700
1951	3 4/	2,300	11 7/	18,400
1952	1	640,890	1	500 8/

1/ Grit and grease chamber for South Essex Sewerage District at Salem-Peabody line.

2/ Includes one community which installed 250 private cesspools serving approximately 1,000 and one community which installed a communitor in 1949 and a new ocean outfall in 1950 serving 10,700, also included in 1950.

3/ Includes one community which installed screening equipment for part of town, one community which constructed sewerage system and ocean outfall, one hospital which constructed additional sand beds, and two municipalities that constructed intercepting sewers for connection to ocean outfalls.

4/ Represents one hospital and two municipalities which installed chlorinators.

5/ Includes one plant treating sanitary wastes only.

6/ Includes one plant that provided pre-treatment and connection to municipal system.

7/ Includes four plants as in 6/ and three others that provide treatment facilities for employee sewage.

8/ Closed white water system at paper mill.

A considerable number of stream pollution prevention and abatement measures are still needed to be placed in effect in the Massachusetts Coastal Streams Basin. There are no significant gaps in the available information on volumes and strengths of wastes discharged and their effects on receiving watercourses. However, studies to determine effective methods of treatment for some industrial wastes are needed as are studies to provide methods for recovery of valuable by-products and to promote greater utilization of raw materials. Effective programs for informing the public and industry in the needs for and benefits from pollution abatement are required as well as programs to promote sound community planning projects to serve the best interests of the majority.

Despite the handicaps, and sometimes opposition, confronting the State Department of Public Health, progress towards the completion of a comprehensive program of pollution control is being made. All of the significant sources of sewage pollution have been located and the requirements for pollution abatement have been determined except where a choice of projects needs study. With no known exceptions, the sources of industrial pollution have been located and the needs for pollution abatement determined for the most part.

From the available information under programs currently in progress it has been established that 37 sewage projects will be needed by municipalities and institutions and these will serve more than 1,421,000 persons. No projects are needed by 31 municipalities and institutions now served by adequate facilities serving nearly 800,000 persons. The municipalities and institutions requiring projects are listed in the body of the report in Table 14.

Table H lists in summary form the needs for sewage treatment, excluding industry.

The proposed program for the prevention and abatement of pollution by industry shows a total requirement of 38 projects to be completed, 36 for the treatment of industrial wastes and two for employee sewage. No projects are needed by 13 plants already served by satisfactory existing treatment facilities. The required projects are needed to treat wastes having a population equivalent of nearly 60,000 persons that are now discharged directly into watercourses. A list of industrial plants requiring projects is given in Table 14 in the body of this report.

Table I summarizes the needs for abatement of pollution by industry and the general type of project to be required is given.

TABLE H

WASTE TREATMENT NEEDS - MUNICIPAL*

Needs	Number	Population Served by Facilities
New Plant	14 1/	1,194,030
Enlargement or Additions to Existing Plant	12 2/	221,560
Replace Existing Plant	1	750
Connection to Municipal System or Other Pollution Control Measures	10	5,110
No Project Required	31	800,090 3/
Undetermined	0	—

* Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

1/ North Metropolitan District Commission System and Boston Main Drainage System to same new plant and counted as one project.

2/ Includes three institutional plants requiring chlorination only.

3/ Does not include population of two military establishments.

TABLE I

INDUSTRIAL* WASTE POLLUTION ABATEMENT NEEDS

Needs	Number
New Treatment Plant	14
Enlargement or Additions to Existing Plant	13
Replace Existing Plant	1
Connection to Municipal Sewer System or Other Pollution Control Measures	10 1/
No Project Required	13 2/
Undetermined	0

* Industries having separate outlets discharging wastes directly to watercourse.

1/ Includes two plants with employee sewage only.

2/ Includes plants with effluents discharged to ground water and not otherwise counted as sources of pollution.

Substantial progress is being made by the State Department of Public Health in requiring action to be taken by municipalities and institutions to provide needed treatment measures. Table J shows the present status of action on pollution prevention and abatement needs.

TABLE J

CURRENT STATUS OF MUNICIPAL* ACTION ON POLLUTION ABATEMENT NEEDS

Status of Action	Number of Municipalities* 1/
Inactive	11
Active Planning	15 2/ 3/
Final Plans Approved	4
Under Construction	7

* Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; signficant institutions, resorts, recreational centers or other population centers.

1/ The actual number of municipalities served by these 37 projects is
- (1) One project for the Boston Main Drainage System and North Metropolitan Sewerage District will serve 18 cities and towns;
- (2) One project for the South Essex Sewerage District will serve four municipalities and in addition, three of these have other local projects;
- (3) Six other municipalities each have two sources of pollution that require separate projects.

2/ Includes three municipalities requested to take action by the State health department.

3/ Includes five municipalities with approved preliminary plans.

To meet the requirements of the program to abate pollution from industrial establishments, action to provide treatment measures for 13 process wastes is being taken. No action is in progress for 23 sources of industrial wastes and two sources of employee sewage requiring pollution abatement measures. Table K shows the current status of action on the pollution abatement needs of industry.

TABLE K

CURRENT STATUS OF INDUSTRIAL* ACTION ON POLLUTION ABATEMENT NEEDS

Status of Action	Number of Industries*
Inactive	25 1/
Active Planning	11 2/
Final Plans Approved	2
Under Construction	0
Undetermined	0

* Industries having separate outlets discharging wastes directly to watercourse.

1/ Includes two industries with employee sewage only.

2/ Includes eight industries requested by letter to take action.

If the above pollution abatement requirements are to be met and the comprehensive water pollution control program to successfully result in the conservation and maximum utilization of the water resources, it must be attained with the cooperation and understanding of the public, industry, and all agencies interested in and concerned with those water resources. Educational programs will enlighten the public and industry in the needs for and benefits to be gained from pollution prevention and abatement. Community planning projects by an enlightened public will result in the development of the water resources in the best interests and welfare of the majority.

There are at least 12 significant benefits attainable from a comprehensive water pollution prevention and abatement program in the Massachusetts Coastal Streams Basin and these follow:

1. There will be a benefit to the public health by the adequate treatment and/or elimination of sources of domestic and industrial sewage pollution by reducing the chances for waterborne disease infection. Sewage polluted waters are always a menace to the public health however remote this possibility may appear to be.

2. Long stretches of presently polluted streams, representing the principal fresh waters of the basin, will be made suitable for development by the important private recreational industry which could, in turn, result in increased employment, income and economic stability.

3. The abatement of pollution of the principal streams of the basin would allow the development of public recreational facilities by State and local governments. Residents could not only benefit from greater opportunities to participate in the outdoor recreational activities of bathing, boating, fishing, hunting and picnicking, but could realize substantial savings in travel costs as well by having these facilities in the community or nearby.

4. Elimination of nuisance conditions at ocean beaches, caused by floating materials of sewage origin, would contribute substantially to the improvement of the aesthetic quality of the bathing waters and beaches. This would materially increase beach patronage by persons now offended by the nuisances sometimes created and offer greater opportunities for all to enjoy recreational bathing benefits. Increased beach patronage would have a further benefit in stimulating income and employment at business establishments dependent on beach attendance and which establishments are a part of the important recreation industry in the basin.

5. Industries now located in the basin could realize a savings through reduction of present water treatment costs to produce a usable process water and some may find it unnecessary to treat process waters at all. In some localities, industries purchasing water supplies from municipal sources may find the improved stream waters to be of suitable quality and quantity for process purposes. The substitution of available stream waters for purchased municipal supplies by industries would represent a savings in production costs.

6. Large volumes of readily accessible waters at the more desirable industrial locations could be made suitable for the attraction of new industry, resulting in increased employment, income and economic stability.

7. Some of the manufacturing plants now producing industrial wastes could realize a significant savings in production costs or waste treatment costs through recovery of valuable by-products and greater utilization of raw materials.

8. Industrial, residential and recreational real estate located on, or dependent on, presently polluted watercourses would be made more attractive and desirable and considerably increased in value by the abatement of pollution.

9. The abatement of pollution of the coastal waters would improve the quality of water now covering condemned clam flats and permit the reopening of many acres now closed to the taking of shellfish. This would result in increased income and employment in the important shellfish industry. It would also be a benefit to the restaurants featuring shore dinners that are dependent on the clam industry for these delicacies. Many visitors and vacationists are attracted to Massachusetts' coast through the fame of her seafood cuisine.

10. Aesthetic nuisances created by gross pollution during periods of critical low flows and high temperatures, conditions offensive to both residents and visitors, would be eliminated by pollution abatement.

11. Industries contributing to damages to water resources would experience a worthwhile benefit from improved public relations through abatement of pollution for which they are responsible.

12. Not the least of the benefits to be gained from a sound program of pollution prevention and abatement, and possibly the most important, are the stimuli to the general welfare and well-being of the basin and its citizens. These benefits will be experienced in the security gained from the knowledge that important resources have been conserved, in the pleasures derived from the restoration of the natural beauty of the streams, in the enhanced reputation of the area in the eyes of visitors, in the greater opportunities for all to enjoy and profit by the use of the water resources and in the satisfaction to the public spirit gained through the completion of a community obligation to safeguard the water resources for which it is responsible.

The extent to which these possible benefits will be realized will be measured by the effort expended towards their attainment.

Section 4

CONCLUSIONS

It is concluded that:

1. Good progress towards the abatement of pollution in the Massachusetts Coastal Streams Basin has been made and action to provide additional needed measures is being taken. There is still a good deal of pollution abatement to be accomplished, however, particularly in the solution of the pollution problems of Metropolitan Boston and in the field of industrial waste treatment.

2. The Massachusetts State Department of Public Health is seriously handicapped by inadequate numbers of personnel and insufficient funds for carrying out comprehensive water pollution control programs. The Department does not have an adequate staff or funds for necessary surveys, investigations, research, public information programs and community planning projects. Pollution control programs are, therefore, carried out over extended periods during which benefits become obscure and the Department's activities oftentimes are opposed by the general public and industry through lack of understanding of the problems and the needs for and benefits resulting from pollution abatement.

3. Water is probably the most important natural resource of the basin and its use for all purposes is widespread. Economically, uses for domestic water supply, industrial water supply, navigation and recreation are most important. Considering the numbers of persons to be served for all water uses, the fresh-water resources of the basin are rather limited. The basin has extensive coastal water resources which are probably more valuable to the general health and welfare than are the fresh-water resources.

4. There have been considerable damages to the water resources from pollution. Damages range in extent from exclusion of use of many waters for recreational bathing to creation of nuisance conditions.

5. The physical characteristics of this lowland coastal basin and the tidal effects permit a low rate of self-purification and recovery from the damages from pollution. Small amounts of pollution result in greater damages to these small coastal streams than occur in inland New England waters.

6. An appreciable number of projects are required to control pollution caused by municipal sewage. One large project is required to treat municipal wastes from the Boston Main Drainage

and North Metropolitan Sewerage District systems that have a total population equivalent of about 2,165,000 persons. Thirty-six small projects are required by municipalities having wastes with a total population equivalent of over 870,000 persons. Project requirements range from chlorination only to construction of ocean outfall sewers with pretreatment units or construction of new sewage treatment plants.

7. A considerable number of pollution abatement measures are needed to control damages to water resources resulting from the discharge of wastes and sewage from manufacturing establishments. Thirty-eight construction projects for new plants, additions to or replacement of existing plants and connections to municipal sewers are required. These requirements are needed to control pollution of wastes having a population equivalent of 60,000 persons.

8. Of the total of 75 pollution abatement measures required, seven are under construction, six have final plans approved, 26 are actively planning construction projects and no action is being taken at 36 sources of pollution.

9. In addition to the known requirements for pollution abatement projects, surveys and investigations are needed to determine the course of action where more than one choice is indicated. Reasonable and equitable methods of treatment of some of the industrial wastes need to be found and studies made on recovery of valuable byproducts and greater utilization of raw materials.

10. A comprehensive water pollution control and stream classification program needs to be formulated and evaluated to determine if proposed control measures will result in water qualities consistent with the intended future uses.

11. The Massachusetts Department of Public Health believes that most of the municipalities and institutions that will be required to construct sewage treatment or disposal facilities can do so now without undue financial hardship and the methods by which these projects may be financed are adequate.

12. The Massachusetts Department of Public Health believes that the majority of manufacturing plants that have been requested to take corrective action to abate industrial pollution can proceed with the recommendations made by methods that are reasonable and equitable.

13. There are at least 12 significant benefits attainable from a comprehensive program of water pollution prevention and abatement on the Massachusetts Coastal Streams Basin.

Section 5

RECOMMENDATIONS

From a consideration of the available data and plans in progress for the control of water pollution in the Massachusetts Coastal Streams Basin, it is recommended that:

1. Immediate progress in submission of plans be required of those municipalities where recommendations on sewage treatment needs have been made and where methods of financing sewage treatment projects are adequate and this, in turn, to be followed by definite action to construct and operate the needed facilities.

2. Where recommendations have been made, and reasonable and equitable methods of waste treatment are available, steps be taken to require the construction and operation of needed industrial waste treatment facilities by manufacturing plants now discharging pollution to the water resources.

3. To comply with Massachusetts Department of Public Health policy on sewage pollution, the municipalities and individuals responsible for the elimination of pollution from private sewers, septic tanks or other sewage outlets take immediate steps to provide or require satisfactory treatment or disposal facilities.

4. Leading to the adoption of a comprehensive water pollution control program, the Massachusetts Department of Public Health classify the streams of the basin for their future intended best uses in the best interests of the public and industry.

5. Sufficient funds be made available to the State Department of Public Health for increasing technical staffs to accelerate pollution abatement programs; to conduct needed studies, investigations and surveys; to develop and carry out a sound program of informing the public and industry in the needs for and benefits from pollution prevention and abatement; and to provide for the promotion and guidance of community planning, all directed towards the desired objectives of a comprehensive plan for the water resources commensurate with future intended best uses.

6. Within the limits of the staff presently available, studies and investigations be made of the best available method, or methods, of treatment of industrial wastes so these data will be on file for use as a basis for recommendations, as a matter of record at hearings, to enforce abatement orders and in court proceedings when appeals of orders are made.

7. Industry cooperate more closely with the State Department of Public Health to determine the most reasonable and equitable methods of waste treatment and the feasibility of reducing costs of waste treatment through recovery of valuable by-products, greater utilization of raw materials and reduction of pollution through better housekeeping.

8. As an aid to the future economic development and welfare of the basin, the comprehensive pollution abatement program evolved be planned so that water resources at the available and desirable industrial, recreational and residential sites will be of a quality most attractive to new investments in manufacturing, real estate, and public and private recreation.

9. All State, local, industrial and private agencies and all sports and recreation clubs, civic organizations, and others who are concerned with and will benefit from conservation of the water resources, cooperate sincerely with the water pollution control authorities in the planning and execution of a comprehensive water pollution prevention and abatement program to insure that the best interests of all will be served and the maximum possible benefits derived therefrom.

Section 6

PHYSICAL DESCRIPTION

Geography

The Massachusetts Coastal Streams Basin is comprised of almost all of the area in Massachusetts draining into the waters of the Atlantic Ocean to the south and east and into Buzzards Bay to the south. Included are the islands belonging to Massachusetts, the most prominent of which are those of Marthas Vineyard and Nantucket. The total watershed area is approximately 2,150 square miles. A very small portion to the extreme north, drained by the Merrimack and Blackwater Rivers, is the only coastal area in Massachusetts excluded from this basin.

Including all the islands, the basin is fronted by more than 2,000 miles of shoreline, constituting the entire ocean front of Massachusetts with the exception of the northernmost six miles. The drainage area extends inland for a maximum distance of about 30 miles and a minimum distance of about five miles, averaging a depth of about 22 miles. The distance between the most northern and most southern mainland points measures about 90 miles. More than 21 small streams drain the basin into tidal waters, the most important being the Ipswich, Charles and Neponset Rivers.

The shape of the basin is very irregular and is distinguished by the rugged coastline typical of New England and by the familiar projection of Cape Cod. Nearly half the basin is in woodland of little value and only about 13 percent is in farms of which slightly more than half the total acreage is in cleared land. About one-third of the area has been classified as urban and almost the entire coastline has been developed for recreation. There are numerous ponds in the watershed, none of which is large. The area has been highly developed and probably ten percent of the total land area has been utilized for roads, residential and industrial purposes and other urban developments.

Topography

The Massachusetts Coastal Streams Basin lies in a coastal lowland that contains considerable swampy or poorly drained lands. In the northern portions of the area there are low undulating hills and in the central regions near Boston there are many lenticular hills ranging in altitudes of 100 to 200 feet. The southern half of the basin is topographically characterized by low rolling hills interspersed with level lowlands. The valleys of the streams contain areas of flat bottom land that are intensively cultivated in truck farming.

The topography of this coastal area is such that the watershed lines between the various sub-basins of the streams in the area are not well-defined nor are the watershed lines distinct between the coastal basin and the adjoining watersheds of the Merrimack and Taunton Rivers.

Geology

The bedrock formation is principally granite that outcrops in many places throughout the basin. The overburden is composed largely of glacial deposits of sand and gravel. Along the valleys of the streams there are alluvial deposits of fertile sandy loam. Cape Cod is a terminal moraine covered by a thin topsoil.

Climate

The basin lies within an area influenced climatically by cold, dry air masses from the polar regions to the north and by moist, tropical marine air from the south. The movements of these air masses over the area result in a succession of alternate low and high pressure conditions that bring about frequent changes of weather. Depending on the season, low-pressure conditions are generally accompanied by snow or rain and those of high-pressure by hot or cold, dry weather.

The climate is temperate and the basin is seldom subjected to prolonged periods of extreme high or low temperatures. Summer temperatures average about 68°F. and winter temperatures average about 28°F. Winters are seldom severe and summers are usually cool and pleasant.

The annual precipitation varies from a low of about 39 inches at the tip of Cape Cod to a high of nearly 47 inches at the Blue Hills observatory just south of Boston, the average for the basin being approximately 42 inches. The amount of precipitation accountable as snowfall varies considerably from year to year and may vary from about five percent of the total to as much as 20 percent, the average over the years probably being less than 10 percent.

Hydrology

The Massachusetts Coastal Streams Basin is drained by more than 21 small streams and the largest of these are the Ipswich, Charles and Neponset Rivers which have watershed areas of about 150, 200 and 170 square miles respectively, after corrections for diversions made. Three other rivers have drainage basins approaching 100 square miles but the majority contain less than 50 square miles.

Approximately 50 percent of all precipitation falling on the basin is accountable in stream run-offs. The volume of run-off varies with the seasons and is generally highest during the months of February through May although high run-offs frequently occur in December, January and June. Low flows are almost always recorded during the months of July through November and sometimes in December and January. The average annual run-off for the total watershed area is computed from the available records to be 1.60 second feet per square mile.

There are eight stream gaging stations in operation in the Massachusetts Coastal Streams Basin and these are cooperatively maintained by the State of Massachusetts and the United States Geological Survey, Department of the Interior. The average annual discharge of run-off into tidewater from the 2,150 square miles of drainage area is estimated to be about 3,400 cubic feet per second, or approximately 2,200 million gallons per day. The Ipswich, Charles and Neponset Rivers account for 240, 320 and 220 cubic feet per second respectively of the total average annual discharge. These latter run-off figures are corrected for diversions made to the public water supplies of Cambridge, Reading, Lynn, Peabody, Danvers, Salem and Beverly. These diversions are eventually discharged into the Atlantic Ocean via the sewerage systems serving these communities. Corrections have also been made for diversion of one-third of the Charles River flow to the Neponset River through Mother Brook.

Table 1, which follows, contains the available stream gaging data for the Massachusetts Coastal Streams Basin.

Table 1--Stream Gaging Data Through Water Year 1947, Massachusetts Coastal Streams Basin

Stream	Gaging Station Location	Date of Continuous Record	Daily Discharge in Cubic Feet/Second		
			Mean Flow	Minimum Flow	Exceeded 95% of Time
Parker River	Byfield	1945	24.7	1.50	--
Ipswich River	S. Middletown	1938	52.3	0.45	1.30
Ipswich River	Ipswich	1930	184.0	1.50	7.44
Aberjona River	Winchester	1939	21.1	0.30	0.57
Charles River	Charles River Village	1937	274.0	2.30	29.4
Charles River	Waltham	1931	261.0	0.20	11.3
Mother Brook*	Dedham	1931	85.6	0.0	--
Neponset River	Norwood	1939	37.1	2.4	7.4

*Entire flow in Mother Brook represents diversion from Charles River to Neponset River.

Hydrologic Effects on Pollution

Compared with other rivers in New England the average fall and velocity of streams in this coastal basin are low, averaging less than two feet per mile from headwaters to tidewater. The streams do not have the extensive rocky bottoms and natural falls of inland New England streams and most meander sluggishly through low agricultural or marshy land much of their lengths.

There were once many dams across these streams to utilize the low heads available, principally to drive water wheels. Thirty years ago the Neponset River had nearly 30 such dams along its course. In the ensuing years many of these waterpower privileges have been abandoned. How many dams are still in existence, and which affect stream flows, is not known but their number is probably still effective hydrologically. The flow from all of the principal streams is subject to tidal action except the Charles River where the lower eight miles are kept at a constant level by a dam at the mouth of the river.

Hourly flows on the principal streams are often affected by regulated water storage practices of plants utilizing flows for hyrdro-power and industrial process water purposes. Some plants practice diurnal regulation, storing all or a part of a day's flow for use during peak power demands and/or during the hours of industrial plant operation. This type of regulation results in low flows between dams during the hours of storage.

Daily flows are also affected by water storage practices during periods of low run-off. At these times industrial plants accumulate water in mill ponds for periods of from one to several days, or whatever period is required to store sufficient water for plant operation. The impounding of water for public supplies also affects daily discharges during periods of low run-off. During periods of regulation, stream flows may be low for periods ranging from one to several days and may at times approach zero at some gaging stations. During dry weather, pumpage of industrial wells along the Aberjona River nearly cause run-offs to approach zero in certain stretches of this stream.

The actual re-aeration rate of streams transporting pollution is not known for this basin. In considering the sluggish flows, frequent impoundments and tidal action, it is concluded that the rate of recovery from pollution of the principal watercourses is low.

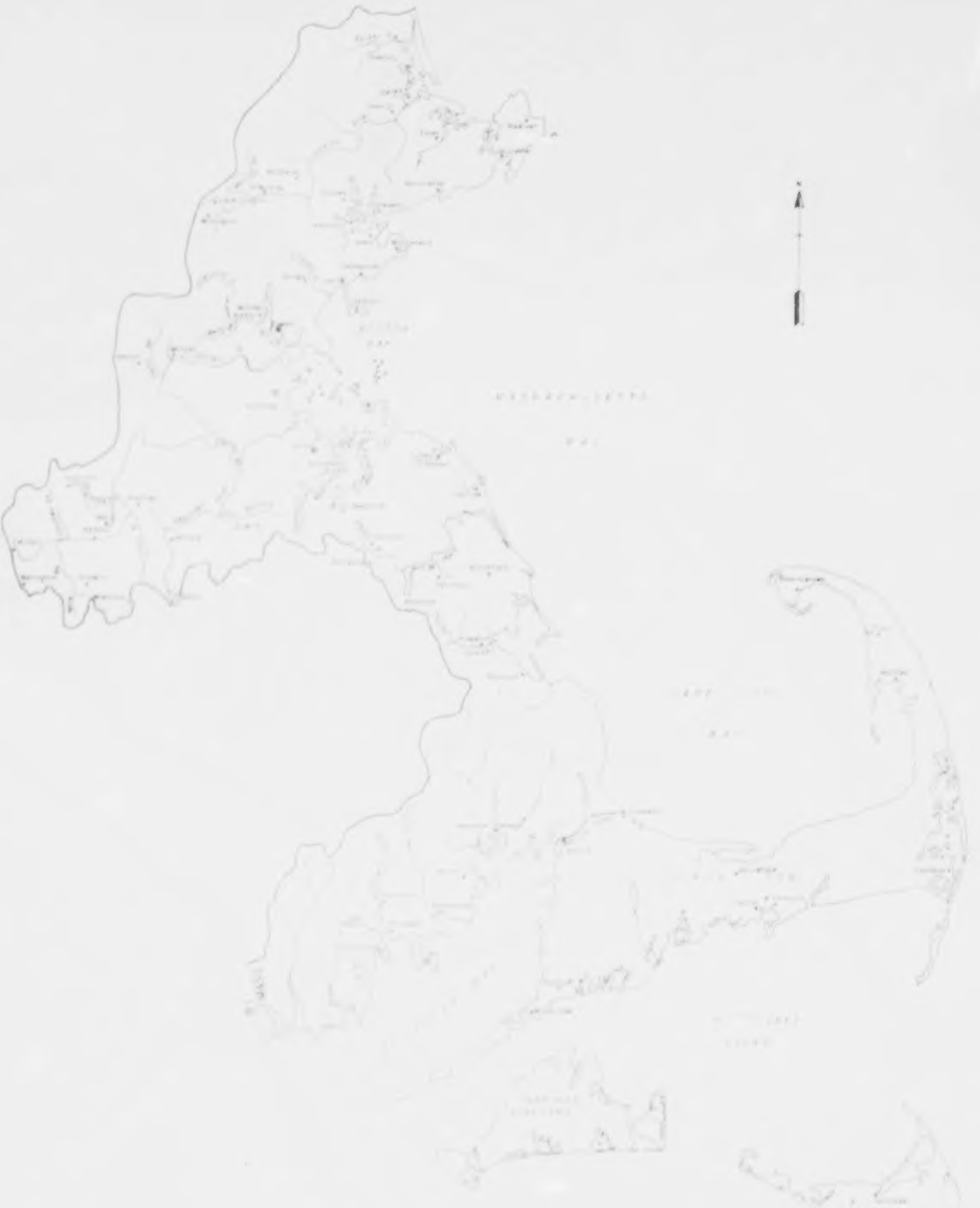
Streams transporting pollution are usually free of ice cover and on ponds ice cover is generally not continuous for any significant period of time. There are no records or information to indicate that critical stream pollution conditions develop as a result of deoxygenation during periods of ice cover on streams or ponds.

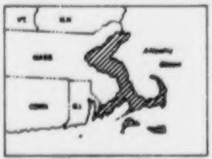
Floods

For the most part there are no areas in this coastal basin subject to general flooding. There are some local areas where flooding occurs that could be remedied by dikes and channel improvements.

During periods of heavy rainfall and high run-off, some of the streams flow over their banks and spread out into the rather extensive marshlands along the valleys. These lowlands act as natural flood control devices and serve to retain flood waters, thus preventing any significant losses in more highly developed areas downstream. Losses from floods, when they do occur, are generally minor in the Massachusetts Coastal Streams Basin.

A general reference map of the Massachusetts Coastal Streams Basin follows.


MASSACHUSETTS BAY
CAPE COD BAY


VT.
N.H.
MASS.
CONN.
R.I.
Atlantic
Ocean

MASSACHUSETTS COASTAL STREAMS BASIN
LOCATION MAP

NORTHEAST DRAINAGE BASINS
BOSTON, MASSACHUSETTS

33-a

MASSACHUSETTS COASTAL STREAMS BASIN

GENERAL REFERENCE MAP

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 1

ARMY NED BOSTON

Section 7

ECONOMIC DEVELOPMENT

Manufacturing

Manufacturing has been associated with the coastal area of Massachusetts almost from the time of the first settlements. Home manufacturing of articles necessary to existence was practiced from the very first. The manufacture of products for commerce began before 1640, less than two decades after the founding of the Plymouth colony.

Dried codfish was the first product manufactured for export. Distilleries soon sprang up to convert the sugar and molasses from the West Indies into rum for export to Africa and Europe. Foreign trade required ships and beginning in 1637 shipyards began to spring up in every suitable harbor. Shipbuilding introduced allied industries and soon rope and ship's hardware were being manufactured.

The first grist mill was erected at Dedham in 1640 and was soon followed by others. Shortly thereafter, sawmills driven by water power began to replace the laborious sawpits. The first woolen and fulling mill in the colonies was built at Rowley in 1643. Maritime commerce continued to be the major economic effort in the colonies and manufacturing remained on a small scale for many years.

When the embargo act of 1807 brought the maritime industry to a temporary halt, manufacturing increased and assumed the position of the leading economic activity, a position it has never relinquished. Capital once invested in commerce on the seas was routed into manufacturing. Water power was available as was an abundant source of labor from farm families no longer able or willing to eke out an existence by agriculture. By 1815, Massachusetts was well on the way into its industrial revolution.

Manufacturing developed along peculiar lines. Whole cities were devoted to the manufacture of a single type of product. In 1890, the workers in Lynn were almost entirely employed by the 323 factories in the city producing shoes. This same pattern in the shoe industry was repeated on a lesser scale in some of the smaller communities. New Bedford was almost wholly influenced by the fortunes of the textile industry in which this city for a time led the nation in the production of fine cotton goods. Other communities were dependent on the woolen and paper industries. Only in Boston and its immediate metropolitan area was there a diversification of manufacture.

With the beginning of the twentieth century, the lush days of unlimited production came to a slow halt. There was a general consolidation of industry throughout the nation in which Massachusetts was unable to follow suit. The absence of fuels and distance from sources of raw materials substantially influenced the decline of Massachusetts manufacturing preeminence. Although closer to foreign markets, the Port of Boston relinquished much of its shipping to New York. Massachusetts' highly skilled labor force, once a jealously guarded asset, became a liability in competing with production costs in other areas employing cheaper labor. A general migration of the traditional New England manufacturing plants into other States was experienced until about 1940. Only the metal and fishing industries continued to thrive and expand.

Efforts to diversify manufacturing in some of the cities have met with good success. The production demands of World War II and the post-war period have increased manufacturing activity and a reasonable degree of production and employment stability has been reached.

There are a number of important manufacturing cities in the Massachusetts Coastal Streams Basin and principal among these are Boston, Cambridge, Quincy, Somerville, Revere, Everett, New Bedford, Chelsea and Waltham. Almost all of the smaller communities in the basin have one or more manufacturing plants and this dispersion of industry contributes substantially to the economic stability of the area. In recent years there has been a large increase in the number of apparel manufacturers and this has made up, in part, the losses sustained from the decline of the cotton textile industry.

The principal products now being manufactured are foods, textile mill products, apparel, paper and allied goods, chemicals, leather and allied commodities, fabricated metal products, machinery, and electrical goods. A large number of plants manufacturing a miscellany of products contribute substantially to the overall economy.

Although the basin experienced a steady decline in manufacturing after 1900, this trend was reversed in the late 1930's. From that time to the present, manufacturing and employment has shown an increase that has been reasonably parallel to the national averages although not so high as in some other industrialized regions. Where the number of production workers employed in the United States from 1939 to 1947 increased 52.6 percent the number of production workers in the basin increased 45.5 percent. The value added to products by manufacture in the United States increased 204% from 1939 to 1947 and over the same period in the basin it increased by 160 percent. During this period the number of manufacturing plants in the basin increased by nearly 16 percent.

Table 2, on the following page, shows by county the estimated increases in manufacturing plants, number of production workers employed and increase in value of products by manufacture during the period 1939 to 1947.

Table 2--Estimated Increases in Manufacturing Growth, Employment and Income from 1939 to 1947, Massachusetts Coastal Streams Basin

County	Establishments-Increase in No. in Basin		Increase in Production Workers		Increase in Value Added To Products By Manufacture	
	Number	Percent	Number	Percent	Value*	Percent
Barnstable	11	35.5	390	182	627.	85.9
Bristol	58	40	5,049	39.5	51,357.	234.
Dukes	1	14.3	(d)	(d)	(d)	(d)
Essex	131	25.7	15,559	42.4	154,090.	192.5
Middlesex	228	19.4	40,823	65.9	326,407.	179.3
Nantucket	0	0	(d)	(d)	(d)	(d)
Norfolk	70	17.8	6,160	26.7	72,750.	109.2
Plymouth	21	17.5	2,178	43.2	18,866.	173.5
Suffolk	272	25.6	29,091	37.2	336,272.	170.
Basin	792	15.6	99,250	45.5	960,369.	160.

* Money figures in thousands of dollars

(d)Withheld to avoid disclosing figures for individual companies

The economy of the region encompassed by the Massachusetts Coastal Streams Basin is very definitely geared to manufacturing and this activity is almost entirely confined to the northern two-thirds of the basin. The basin contains 24 percent of the land area of Massachusetts yet it contains more than half of all the manufacturing plants in the State, employs approximately 44 percent of all manufacturing employees and accounts for nearly 50 percent of the value added to all products by manufacture in the Commonwealth. The basin contains the Boston standard metropolitan area which is the largest in New England, such an area being defined by the U. S. Department of Commerce as one which has 40,000 or more manufacturing employees.

Pertinent general statistics on manufacturing employment and income by county are given in Table 3.

Table 3--General Statistics on Manufacturing
Employment and Income in 1947,
Massachusetts Coastal Streams Basin

County	Estimated Number of Establishments in Basin	All Employees: Average No. for Year	All Employees: Total Wages Received*	Value Added to Products by Manufacture*
Barnstable	42	604	1,358	2,468
Bristol	203	17,844	42,537	73,236
Dukes	8	(d)	(d)	(d)
Essex	640	52,223	135,671	234,181
Middlesex	1,405	102,867	276,740	508,471
Nantucket	2	(d)	(d)	(d)
Norfolk	463	29,249	83,541	139,294
Plymouth	138	7,215	17,479	29,745
Suffolk	2,982	107,257	294,018	572,645
Basin	5,883	317,259	851,344	1,560,040

* Wages and value added to products figures in thousands of dollars

(d) Withheld to avoid disclosing figures for individual companies

In these days of increased production for national defense and increased domestic demands for goods, it is expected that there should be a continued industrial growth in the Massachusetts coastal area. It is generally conceded that there are regional disadvantages in lack of fuel resources, higher wage scales, comparatively high electric power rates and unfavorable shipping costs, both for incoming raw materials and outgoing finished products. Offsetting these disadvantages are the advantages of a large, skilled labor force, excellent transportation facilities, and desirable industrial plant sites. The industrial advantages are generally considered to outweigh the disadvantages and it is expected that the basin will continue as one of America's important industrial centers.

Agriculture

For nearly 200 years after the landing of the Pilgrims at Plymouth, agriculture was the principal occupation. With the rise in manufacturing following the close of the War of 1812, agriculture declined steadily. There had been some competition from farm products of the frontier Midwest around the turn of the nineteenth century but in 1825, after the opening of the Erie canal, produce from the west flowed east in a volume with which the small New England farms could not compete. Subsequently, many farmers were faced with the alternative of working in factories or migrating westward to establish new farms and homes. Many farms were abandoned and the land allowed to revert to its natural state. The farmers who remained turned to specialty farming to supply nearby factory cities.

Farming activities, as practiced at present, are intensive and directed particularly into the fields of dairying, poultry raising, fruit growing and truck gardening. A large area in the Cape Cod section is devoted to cranberry bogs which produce approximately two-thirds of the nation's crop. Approximately seven and one-half percent of the total basin area is in cleared farmland and of this amount, about six percent is in cultivated crops. Roughly one percent of the farmland is in pasture and the remaining one-half percent is lying idle.

Table 4 contains data on the average size, value and income for farms by county in 1949, together with the estimated value of all farm products sold in the basin in that year. These data are based on advance reports of the 1950 agricultural census taken by the U. S. Department of Commerce.

Table 4--Data on Farm Size, Value and Income,
Massachusetts Coastal Streams Basin, 1949

County	Average Acres Per Farm	Average Value Per Acre	Average Income Pr Acre	Value of All Products Sold*
Barnstable	19.3	287.	150.	2,383
Bristol	34.5	145.	128.	1,805
Dukes	82.9	87.	139.	249
Essex	49.6	241.	111.	4,300
Middlesex	44.8	197.	117.	3,280
Nantucket	263.7	79.	23.	21
Norfolk	37.8	256.	141.	8,850
Plymouth	36.8	210.	106.	9,550
Suffolk	6.5	1,638.	1,430.	637
			TOTAL	31,077

* Value of all products sold in thousands of dollars

The value of all farm products sold in the basin in 1949 was an estimated $31,000,000. The sale of livestock and livestock products accounted for 62 percent of this total, nearly all of the income being from dairy and poultry products. Cranberries are an important specialty crop in Plymouth and Barnstable Counties. This product is estimated to have an annual value of over $3,000,000 and accounts for about 10 percent of the basin's agricultural income.

Although the value of all farm products sold is only about one-fiftieth the value added to products by manufacture, the income from agriculture is significant to the economy of certain areas in the basin. The basin contains only 14 percent of the cleared farmland in the State and yet its farms account for nearly 30 percent of the value of all farm products sold in the Commonwealth. Truck and dairy farms are of special significance in the support of the urban areas. The increasing tendency of urban dwellers to drive into rural areas to purchase fresh farm produce will probably cause the establishment of more small truck and poultry farms.

Recreation

Recreation in the Massachusetts Coastal Streams Basin is big business. In addition to containing one of the ten largest metropolitan populations in the nation, the area is annually invaded by thousands of recreation-seeking vacationists and visitors. The basin contains some of the most favored and intensively developed recreation areas along the Atlantic seaboard.

Both the North Shore and South Shore in the vicinity of Boston have been highly developed for recreation, much of which is designed to serve the general public. These facilities include bathing beaches, amusement parks, scenic drives, parks and reservations, bridle paths, golf links, zoos, historic sites, yacht clubs, art and science exhibits and both ocean and inland game fishing opportunities. Many of these facilities have been developed by private capital but most have been provided by public funds.

There are two State parks, one State forest and two State reservations in the watershed. Eleven privately administered reservations are open to the public. The Metropolitan District Commission operates 16 public recreational areas, not including playgrounds, scenic drives and other similar facilities. For the use of the public the City of Boston has provided eight principal recreation sites such as an arboretum, an aquarium, a zoo, a museum and other points of interest. Cities and towns in the basin maintain many other recreational areas, most having picnicking and bathing opportunities although very little of the last is supervised or provided with sanitary and bathhouse facilities.

The investment of capital in private recreational development has been tremendous. Untold millions of dollars have been invested in amusement parks, summer hotels, summer estates and homes, cabins, private bathing beaches, golf clubs, riding academies, yacht clubs, fishing craft, etc. In the Cape Cod and Buzzards Bay areas, the basin contains some of the most valuable and highly developed recreational lands in the United States.

The value of private lands developed for recreation in the Cape Cod-Buzzards Bay area is probably unequaled by any other area of similar size in the country. Practically all areas in the basin affording opportunities for recreational development command a premium price and this is particularly true of lands fronting on, or having access to water, whether the ocean or a fresh-water pond. Competition for recreational real estate having usuable water resources is keen, reflecting the popularity and need for water recreation in this congested area. The most needed recreational opportunity in the basin is water for day use bathing by the general public.

Although it ranks far below manufacturing in income, recreation is nevertheless significant to the general economic welfare of the basin and is particularly important in the economy of the southern third of the area. The present annual income of the recreation industry is not known but judging from similar recreation areas, it is estimated to be $20,000,000 or more. If one includes the eating establishments, famous for their seafood cuisine and which cater to the vacationing public, the recreational income is undoubtedly considerably in excess of $20,000,000. As in most metropolitan areas there is a tremendous value in recreation to the general health and welfare.

Forestry

Although more than half of the basin is in woodland, very little is of commercial value. Woodlands are for the most part second and third growth mixed hardwoods and conifers. Most of such growths in the southern portion of the basin is of the scrub variety.

The income from all forest products sold from farms in 1949 was approximately $80,000. Much of this income was from the sale of firewood and some was used in the manufacture of furniture and other wood specialty products. There is no lumbering activity in the basin.

Mining and Quarrying

Almost all of the granite production in Massachusetts originates in Quincy and Rockport, both of which are in the basin. The output of granite from these two sources exceeds that of any other New England State. Granite may be quarried at many places in the northern two-thirds of the watershed but operations are almost entirely confined to the above two communities. The value of granite quarried is not known but, inasmuch as this stone is widely used in construction and in the manufacture of memorials, it is estimated to be several million dollars per year.

There are no other minerals quarried or mined on a commercial scale.

Commercial Fishing

Boston is one of the principal fishing ports in the United States and Gloucester is second in importance in the basin. Fishing is also significant commercially in New Bedford, Provincetown and Rockport. In the banks off the coast of Massachusetts lies one of the richest fishing areas in the world. In recent years improvements in refrigeration and transportation have stimulated a larger market for fresh seafoods. During the meat shortages of World War II, the fish filleting business expanded greatly and the market established has continued to be of considerable commercial significance. The growth of the poultry-raising industry and improvements in feeding practices has greatly increased the production of poultry concentrates by fish reduction plants. Reduction plants utilize both whole fish and gurry from filleting processes. This industry has become so important that some reduction plants maintain fishing fleets for the sole purpose of reducing the catches to poultry feeding concentrates.

An important shellfishing industry has long existed on the Massachusetts Coast, particularly in Massachusetts Bay. There is a large harvest of softshell clams, quahaugs, scallops, oysters and lobsters that are not only shipped to markets throughout the country and utilized in the canning industry but support a large number of eating establishments famous for shore dinners.

In 1950, nearly 523,000,000 pounds of fish were landed at Massachusetts ports, the value of which was over $36,500,000. This does not include all shellfishing operations which annually produces an income over a million dollars. The value of these landings after processing by deep freezing, filleting and canning probably approaches, or exceeds, $100,000,000 annually. The commercial fishing industry will undoubtedly continue to grow as the markets are further expanded and the number of prepared fish products is increased.

Population

The population of the Massachusetts Coastal Streams Basin has shown a steady growth through the years. In the past, the population growth in the basin has been generally greater than for the State as a whole but during the past decade these increases were almost identical. In addition to the natural forces of multiplication, the growth of population in the past has been stimulated by large influxes of immigrants, largely from Europe. The greatest population increase through immigration occurred during the years of expansion of the manufacturing and fishing industries in the last century. Immigrants still account for an appreciable share of the increase in the present population.

In 1930 the population of the basin was an estimated 2,250,000; in 1940 it was an estimated 2,456,000; and from the preliminary releases of the seventeenth census, the 1950 population was computed to be 2,653,000. The largest increases in population since 1940 have been recorded in the suburban cities and towns surrounding Boston. The smallest increases and the decreases in population have largely occurred in the small southern towns and in the larger industrial cities of New Bedford, Chelsea and Revere. The 1950 population figures indicate an eight percent increase over the 1940 census and a population density of 1,235 persons per square mile. The population density is more than twice that of the State and approximately twenty-five times that of the United States as a whole.

There are 57 cities and urban towns in the basin of which five are partly in adjoing watersheds. Persons living in urban areas account for approximately 93 percent of the total population, about five percent of the population reside in villages in non-urban towns and the farm population is less than two percent of the total population. Metropolitan Boston contains nearly 80 percent of all the residents in the basin.

Boston is the largest city with a reported 1950 population of 801,144. Cambridge is the second largest city with a population of 120,740. There are two other cities with populations exceeding 100,000; six cities have populations between 50,000 and 100,000; 12 cities and towns have populations between 25,000 and 50,000; 23 cities and towns contain between 10,000 and 25,000 residents; and the remaining 80 towns in the basin have less than 10,000 residents.

The 1940 and 1950 populations of cities and towns in the Massachusetts Coastal Streams Basin are appended at the end of this report in Appendix "C."

Income

Accurate data on the income of residents are not available but there is enough information to give a reasonable indication of the incomes of certain groups. In 1947, all manufacturing employees averaged an annual wage or salary of about $2,700. With the general wage increase pattern of the past four years, the average wage of manufacturing employees has probably risen to about $3,100 per year. Buying power surveys in industrial areas have shown that there is generally more than one wage earner per family and the average family income of persons employed in the manufacturing fields is probably between $4,500 and $5,000 per year.

The average income per farm, which should approximate the farm family income, was $4,300 per year in 1945. There has been a substantial increase in the value of farm products since 1945 and probably the average farm income in the basin today exceeds $5,000 annually. Average farm incomes vary considerably by county and may range from about $3,000 in Barnstable County to approximately $10,000 in Suffolk County.

The incomes of the self-employed and of the service and professional groups are not available but the per capita income figures would indicate that, on the average, this group earns approximately the same annual wage or salary as the manufacturing employees. The 1950 Dun and Bradstreet reference book lists the per capita income in Massachusetts at $1,417. Since this figure includes all incomes from all sources, it is somewhat higher than the per capita income of those working for wages and salaries. It is estimated that the average income per family in the Massachusetts Coastal Streams Basin was approximately $5,000 per year in 1950. This indicates that the family incomes in the basin were higher than in the nation as a whole.

Section 8

USES OF THE WATER RESOURCES

General

From the time of the first white settlement at Plymouth, the water resources have been important in the welfare and development of the area. From 1620 to the present, the streams have served importantly as sources of domestic water supply. Their large fish population served two essential roles in the subsistence of the early settlers, being an important supplement to the daily diet and almost a necessity in fertilizing the barren soil.

The excellent harbor facilities sheltered a thriving ship building industry for many years and made possible a great maritime commerce. Although maritime commerce has dwindled through the years, it is still important in the regional economy and the Port of Boston is one of the nation's more important shipping centers.

With the growth in manufacturing the rivers and streams provided power and sources of process waters. The surface waters of the area have long supported a large farm animal population. In comparatively recent years, the surface waters have played an increasingly important part in the recreational needs of the residents and fostered a recreation industry significant to the regional economy and welfare.

Compared to other river basins, these coastal streams are quite small but have nevertheless proven to be one of the area's most important assets. The basin enjoys an above-average rainfall, rather evenly distributed over the year. The U. S. Geological Survey has collected run-off data on five of the principal streams for a number of years. This agency has also recently concluded a number of general tests on the ground water resources of Metropolitan Boston, Cape Cod and the Fall River-New Bedford area. A report analysis of the results of these ground water studies is in progress.

A joint field survey recently completed by the Massachusetts Department of Public Health and the Public Health Service has provided much additional information on the uses of the basin's water resources. The demands on the water resources for most normal uses have increased steadily for a number of years and some of these uses are in conflict with one another. There now appears to be a sufficient inventory of the water resources to permit the adoption of a comprehensive plan for their fullest practicable development and use.

Map No. 2 shows the principal water resources and their present uses.

Domestic Water Supply

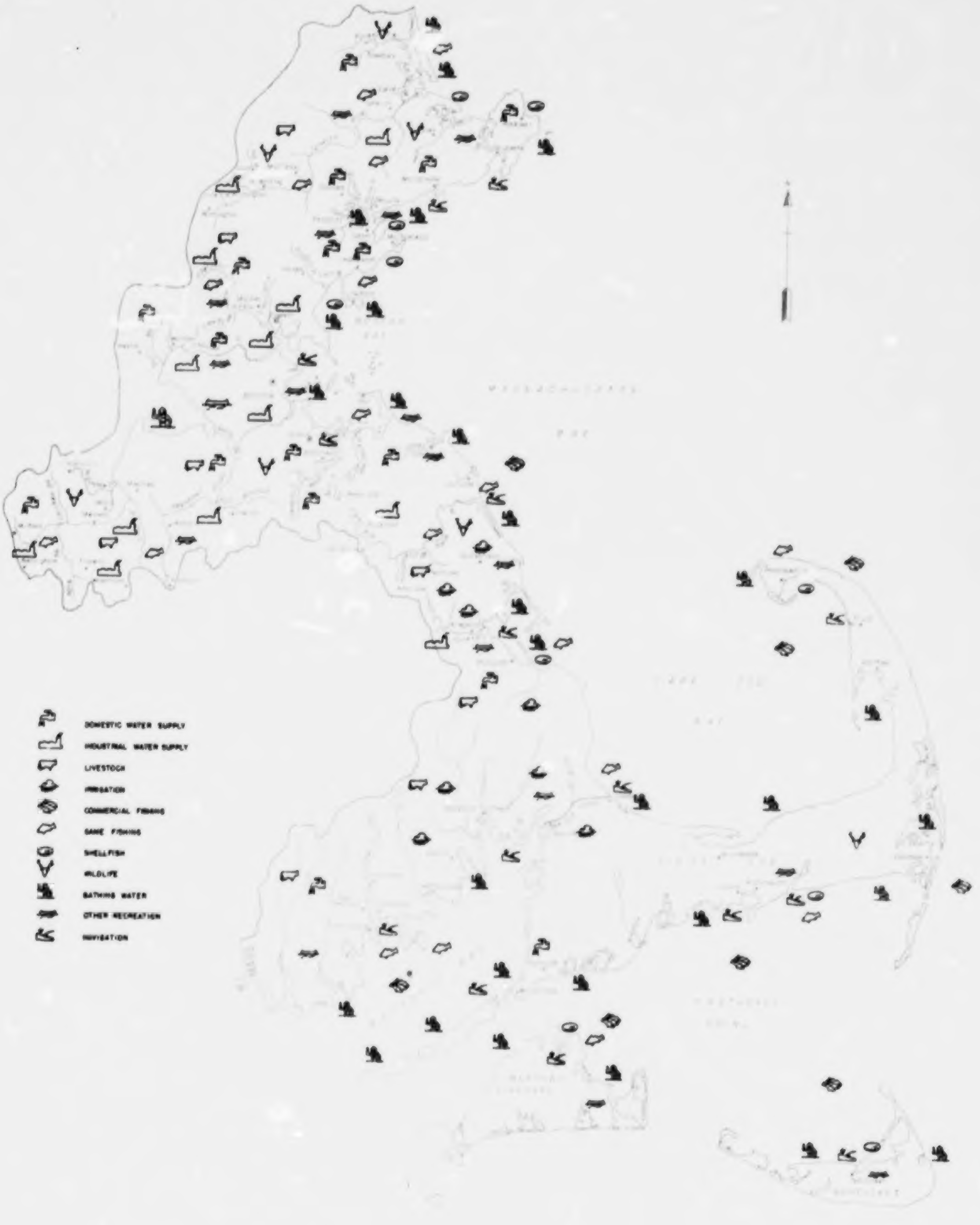
The highest use of the inland water resources is for domestic water supply. All of the public surface water supplies are taken from watersheds protected from pollution and subjected to periodic sanitary inspections, except those supplies taken from the Ipswich River. Many of the small public supplies have been developed from the ground water resources. All public water supplies in this basin are approved by the Massachusetts Department of Public Health and this department maintains vigilance over the safety of these public utilities through programs of inspections and analyses.

There are 131 communities served by 79 water systems, including Brockton and Pembroke. Twenty-eight of these communities are served by the water supplies of other communities and 22 cities and towns are served by the Metropolitan District Commission water system. Six communities have municipal supplies, but a part of their populations are also served by the facilities of neighboring communities. There are two jointly-operated supplies, each serving two communities. One town is served by the water supply of a State institution.

Not all the water supplies originate from the water resources within the basin. The Metropolitan District Commission water supply is derived from the watersheds of the Connecticut and Merrimack Rivers and the water supply of Newburyport serving the Oldtown section of the town of Newbury is also taken from the Merrimack Basin. Conversely, the city of Brockton lies outside the basin but takes its water supply from Silver Lake which is in the basin. There have been developed 25 surface water supplies and 56 ground water supplies within the basin. A few of the surface water supplies have auxiliary sources in ground waters and the reverse is true of several of the ground water supplies.

There is a total of 2,603,100 persons in the Massachusetts Coastal Streams Basin served by public water supplies and this represents 95 percent of the total population when Brockton and Pembroke are included. Surface water supplies serve 2,235,790 persons and ground waters serve 367,310 persons. Watersheds outside the basin supply surface water for 1,510,840 of these persons and watersheds within the basin serve 724,960 persons, including 63,350 persons residing in Brockton and Pembroke.

Rather complete data are available on public water supply consumption in the basin which is estimated to be 293,326,000 gallons per day. A total of 181,940,000 gallons per day are delivered by systems with sources outside of the basin and the remaining 111,386,000 gallons are derived from sources within the basin. Surface waters furnish an average of 257,335,000 gallons per day and ground waters the remaining 36,932,000 gallons. These figures average a per capita water use of about 115 gallons per day, indicating that an appreciable quantity, perhaps 30 percent, is purchased by industry for process purposes. The per capita consumption from the Metropolitan District Commission supply is 120 gallons per day and this supply serves the most highly industrialized area in the basin.


DOMESTIC WATER SUPPLY
INDUSTRIAL WATER SUPPLY
LIVESTOCK
IRRIGATION
COMMERCIAL FISHING
GAME FISHING
SHELLFISH
WILDLIFE
BATHING WATER
OTHER RECREATION
NAVIGATION
MASSACHUSETTS
BAY
CAPE COD
BAY

MASSACHUSETTS COASTAL STREAMS BASIN

EXISTING PRIMARY WATER USES

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO 2

45-a

ARMY NED BOSTON

With three exceptions all surface waters are disinfected with chlorine before distribution. Several receive filtration and chemical treatment for corrosion control. Most of the ground water supplies are distributed without treatment. A few ground waters are chlorinated, others are given chemical treatment for corrosion control, and five are filtered for iron removal.

In recent years several cities and towns have experienced public water supply shortages that have been caused primarily by increased demands and partly to effects of drouths on run-offs and ground water levels. Communities which require additions to present supplies or development of auxiliary or emergency supplies, are as follows: Brockton, Salem-Beverly Water Supply Board, Peabody, Marblehead, Gloucester and Rockport. In addition, the North Reading State Sanatorium and the Medfield State Hospital require enlargement of present institutional water supplies. Most of these new auxiliary or emergency water supplies will need to be taken from surface waters although some small supplies will probably be developed from ground waters.

The city of Newton has shown a large growth but will soon obtain all of its supply from the Metropolitan District system as will the town of Brookline. Marblehead, now partly served by Lynn, probably will be connected to the Metropolitan system and the towns of Wakefield and Reading have indicated a desire to do likewise. The Metropolitan District water supply, which now serves all or part of 22 cities and towns that contain 60 percent of the basin population, has in its Quabbin and Wachusett Reservoirs a storage capacity of 480 billion gallons. The estimated safe yield of the watersheds of these two reservoirs is 335 million gallons per day, almost double the present daily demand.

The quality of public water supplies in the basin is generally very good. The surface waters tend to be quite soft and of good chemical quality, although sometimes high in color. Ground waters are relatively soft and on the average of good chemical quality. A few of the ground waters are high in iron which is removed before distribution.

Appendix "D" at the end of this report is a census of existing public water supplies in the Massachusetts Coastal Streams Basin.

Nine institutions in the basin have developed private water supplies of which one is served both by its own supply and by a municipal supply.

Nearly 6,800 persons residing or employed in eight of these institutions are served by water supplies but the population served at one military installation is not available. All of the supplies serving institutions are approved by the State health department and, with the exception of the North Reading State Sanatorium and the Medfield State Hospital, none has any reported water supply problems. The average daily consumption of water in institutions is not known but from the available information, it is estimated to be, excluding military reservations, approximately one million gallons, a per capita consumption of 150 gallons per day.

Appendix "E" is a census of institutions in the basin which have individual water distribution systems.

Persons not residing in communities served by public water systems are served in almost all instances by dug or driven wells. The quality of these shallow ground waters is generally good. Approximately 131,200 persons residing on farms, in small villages or in rural areas are dependent on privately-owned water supplies. Additional thousands of summer vacationists are similarly supplied in recreational areas by wells or springs owned by resort hotels, lodges and camps. Most of the latter supplies are subject to inspection and approval by the State health department.

Industrial Water Supply

The use of the basin's water resources for industrial purposes is second in importance only to the use for public water supply. The basin is highly industrialized and contains more than 5,000 manufacturing establishments of all types. It is estimated that nearly 700 of these plants employ one or more "wet processes" requiring waters of varying qualities. Most of the latter industries are concentrated in the larger manufacturing cities and towns, particularly Metropolitan Boston, and are served by existing public utilities, including water supplies.

The largest amounts of industrial process waters are consumed in the basin by the textile, paper, chemical, leather, food and metal processing industries. Public water supply systems furnish the greatest volume of process water to industry and there is also a large volume of salt water used for cooling and seafood processing purposes. Manufacturing plants located outside areas served by public water supplies, or located on streams and ponds having water qualities suitable for industrial process purposes, utilize an appreciable quantity of the basin's fresh water resources. The smallest volume of industrial process water is derived from the ground water resources. A few manufacturing plants utilize combinations, or all, of the above water sources to obtain the quantity and quality of process waters needed.

The joint field survey of uses of the water resources recently completed in this basin has provided more information on industrial water use than has been available heretofore. Because of the limited personnel and funds available the field survey was necessarily confined almost entirely to manufacturing plants located outside of the larger industrial cities. Within this category a total of 122 manufacturing plants were surveyed and data on source and volume of process water were determined for 110 plants, there being 12 where such data could not be determined accurately and for which average volumes were taken.

The vast majority of the manufacturing plants located in the larger industrial centers purchase process waters from public water systems. Industrial plants located on streams or ocean frontage in these cities were included in the field survey. From data existing in records of the State health department and from studies of public water supply records, it was estimated that the average domestic water consumption in the basin at the present time is about 85 gallons per capita per day. Included in domestic water consumption are the commercial uses normally made in most residential cities, such as by restaurants, laundries, bakeries, etc. For the volume of water supplied to industry by public water supply systems in the larger manufacturing cities in this basin, it was estimated that all pumpage above 85 gallons per capita per day was purchased by industry for process purposes.

On the basis of the field survey data, State health department files, public water supply records and computations made, it is estimated that the total process water use by industry from all sources averages at least 113 million gallons per day at the present time. Fresh water resources furnish 109 million gallons of this requirement and salt waters account for the remaining four million gallons used daily by industry for process purposes.

Of the fresh water resources required daily by industry in the basin, 82.5 million gallons are purchased from public water supply systems, 19.5 million gallons are taken from available streams and ponds, and seven million gallons are derived from industrial well supplies. The largest consumers of fresh water resources are the textile, leather and paper industries. Seafood processing plants use almost all of the salt water taken for process purposes in the basin.

The salt water resources are used in large volume for cooling purposes in plants located on tidal waters. The amount of salt water used for cooling purposes by industry is not known accurately but from data accumulated during the field survey, it is estimated to exceed 600 million gallons per day. Almost all of this cooling water is used by steam-driven electric power generating plants and a very small fraction is used by the coal and petroleum processing industries.

The economy of the basin is definitely geared to manufacturing and the increase in the number of industrial establishments since 1939 is approaching 20 percent. This indicates an increase in demand for industrial process waters that has been reflected in increased public water supply consumption in cities and towns largely furnishing industry's needs. The continued industrial growth of the basin is forecast by economic surveys recently completed and, in the northern half of the basin in particular, this growth will require the use of most of the watershed's usable fresh water resources. The use of the streams by industry to transport its own untreated and inadequately treated wastes is in conflict with its own needs for process waters, whether these be taken directly from watercourses or purchased from public supplies that are dependent on the basin's surface waters for new or expanded facilities.

Recreation

Recreational usage of the water resources of the Massachusetts coastal region has long been one of the most important made. The use of the water resources for this purpose is diverse and widespread. Bathing, game fishing, boating and yachting are the most popular forms of water recreation. The water resources are also important in the choice of picnicking and camping sites and are necessary in the support of wildlife for recreational game hunting. The water resources not only support an economically important recreational industry but are vitally needed as a recreational outlet for a large, permanent population.

The recreation industry has grown steadily through the years and the use of the water resources for recreation has assumed considerable importance. Long stretches of shoreline along ponds, lakes and the ocean have been developed or preempted for development by private or commerical investments in summer residences, resort hotels, camps, yacht clubs and other recreation seeking groups. Much of the recreational development outside of the Metropolitan district has been by private capital. Traditionally, most of the developed recreational facilities in New England have been a product of private capital and this trend is expected to continue. Recreation is an important phase of the region's economy and programs for the encouragement of this industry are in progress.

There is a definite need and demand for more public recreation areas, particularly those which will afford bathing and game fishing facilities and this has been expressed by the public park and recreation agencies. These agencies have programs to develop recreation areas where suitable sites can be found and when funds for such purposes have been provided. In recent years many town have provided some public recreation areas and more such development at this level should be encouraged. Only about one-fifth of the approximately 300 public bathing areas have been provided with sanitary facilities and less than one-tenth with bath houses. More extensive development of the existing bathing areas is needed.

The demands of both public and private recreation are placing an ever-increasing burden on the water resources. There are many potential recreational sites in the southern half of the basin that have not yet been fully developed. The greatest shortage of recreational water exists in the vicinity of Metropolitan Boston. Here, where the need for public recreation is probably greatest, the opportunities for water recreation are fewest. To meet the demands of the thousands of persons requiring recreational outlets, almost all the usable water resources within a reasonable travel distance of this congested area will need to be utilized.

Livestock Watering

Livestock water is an essential use of the water resources of the Massachusetts Coastal Streams Basin. The farm animal population is relatively high and in pasture a large part of the year. During this time, farm animals are dependent in most instances on the available surface waters for drinking supplies. Because the area contains many ponds and much low, swampy land it is well-suited to duck farming. Considerable areas have been fenced off for this purpose and this activity adds appreciably to the total farm income.

Nearly 62 percent of the farm income is derived from the sale of livestock and livestock products, nearly half being from dairy products. Since livestock represents such a large proportion of the total farm revenue, the availability of adequate sources of reasonably clean and palatable water for livestock watering is important.

Irrigation

Irrigation is not a widespread use of the water resources of the basin and this use is confined to watering truck gardens. The acreage irrigated and the volume of water used are not available. Although it represents a relatively small water use, irrigation practices are very important to the truck farmer as watering certain crops at the proper time has been demonstrated to result in larger yields of better quality than unwatered crops. Irrigation practices are being advised by State and Federal agricultural agencies and the use of water for this purpose will probably become greater as more truck farms are established.

Commercial Fishing

Commercial fishing has been associated with and been of large importance to Massachusetts since nearly the time of the first settlements. Today, Boston is one of the leading fishing ports in the United States. The fish of greatest commercial importance, however, do not come from the water resources of the basin but from the banks off the Massachusetts coast. The coastal waters are important to commercial deep sea fishing, however, in that they contain the shore installations, harborage and shipbuilding facilities needed to support this industry.

The softshell clam, quahaugs, scallop, oyster and lobster yields are of considerable economic importance. These marine products of the Massachusetts coast provide employment and income for several hundred persons. In 1950 the income from the sale of clams and lobsters was more than $1,150,000. Probably more important than its own income and employment is the support these industries lend to the restaurant and recreation industries. The basin contains many eating establishments long famous for their seashore cuisine. The fame of Massachusetts seafood dinners has unquestionably brought many thousands of visitors and vacationists to its coast.

The demand for softshell clams, quahaugs, scallops, oysters and lobsters will undoubtedly increase as the recreation industry grows and the sale of these products is promoted. The largest single deterrent to increased production is pollution of the coastal waters which has caused the closing of hundreds of acres of producing clam flats.

Wildlife Habitat

The importance and use of the water resources to wildlife in the basin is largely in the relation between sports hunting and recreation. The basin contains extensive marshy areas that accommodate large numbers of migratory water fowl in season and duck hunting is very popular along the entire mainland and on the islands to the south. The basin also supports considerable upland game and many sportsmen engage in recreational rabbit, pheasant and even deer hunting. Drainage programs for land reclamation and mosquito control would reduce shooting areas and water fowl populations and should be correlated with waterfowl management programs.

The lowland water resources also support an important wildlife industry where marshlands have been tightly fenced and muskrat farming is practiced. The income from this specialized use of the water resources is reported to be appreciable.

Navigation

Only the tidal estuaries of the larger rivers are commercially navigable. Two of the three major ports of Massachusetts are at Boston and New Bedford. The Port of Boston has an area of 47 square miles and a water frontage of 140 miles. New Bedford Harbor is a tidal estuary on the Acushnet River and the outer harbor has an area of about six square miles. There are other protected anchorages at Gloucester, Manchester, Lynn, Saugus, Plymouth, Nantucket, Rockport, Edgartown, Vineyard Haven, Cuttyhunk and in Buzzards Bay. The Cape Cod Canal though Cape Cod to Buzzards Bay is an important navigation route from Boston to New York and southern ports.

Boston Harbor is by far the most important of the navigable harbors. It has three main channels and a number of other channels dredged to certain terminals. The harbor has 1,500 acres of harborage and waterfront facilities include over 200 wharves. The principal piers have track connections for direct transfer of cargo between railroad cars and seagoing ships.

The freight traffic during the year 1950 in the Port of Boston, including freight entering and leaving and intra-harbor traffic, was 18,194,438 net tons. Ocean-going ships listed a total of 35,828 passengers. Ferry services in the harbor and coastwise steamers accounted for 2,102,696 passengers.

In addition to commercial freight, fishing and passenger ships, the harbor waters of the basin provide anchorage for large numbers of pleasure craft. At Quincy, on the Fore River, is one of the largest shipyards on the eastern seaboard. The use of harbor waters for navigation purposes is extensive and the existence of these navigable waters has long been of large importance to the economy and welfare of the Commonwealth.

Hydroelectric Power Generation

There are few water power developments on the streams in this basin. The rivers have comparatively little fall and in the summer months are subject to low discharges. There are no practicable sites for water storage for use in water power development.

Twenty years ago, there were more than 40 dams utilized for power purposes, mostly to drive water wheels. These privileges have been gradually abandoned because it has been cheaper to purchase electric power than to maintain the water power facilities. Probably less than 20 of these dams are still in use.

The amount of hydroelectric power being generated at the present time is insignificant in comparison to the number of kilowatts required in this highly developed area. There are six hydroelectric power installations in operation; three on the Charles River and three on the Neponset River. The Charles River installations include one utility plant and two industrial plants. On the Neponset, there are two utility plants and one industrial plant. The three utility plants have a combined installed generating capacity of 500 kilowatts and the three industrial installations have a combined capacity of 1,022 kilowatts. Utility plants accounted for the production of 767,000 kilowatt hours of electricity in 1949 and the industrial plants generated a total of 866,500 kilowatt hours during this same year.

Hydroelectric power generation is greatly limited by the unsuitability of the natural facilities and the power needs of the basin are met by steam-driven electric power generating plants and by the power grid that serves most of New England.

Transportation of Wastes

The waters of the basin have been required to transport wastes for many years. As the basin grew into one of the most populous and highly-developed areas in the nation, the coastal streams were required to carry away ever-increasing amounts of wastes. Today the inland streams and harbor waters receive millions of gallons of sewage and industrial wastes daily.

The use of the water resources as the final place of disposal for liquid domestic and industrial wastes is indispensable in such a highly populated and industrialized region. However, in several areas this use has been in conflict with other legitimate and necessary water uses. The disposal of large volumes of untreated or improperly treated sewage and process wastes into the water resources has become particularly incompatible with the uses for recreation and shellfish propagation. In some areas it has created nuisance conditions.

Section 9

POLLUTION CONTRIBUTED TO WATER RESOURCES

General

Although the Massachusetts Coastal Streams Basin is a densely populated and highly industrialized area, there are relatively few separate sewage and industrial waste pollution outlets. The basin contains 131 communities that are served by public water supplies and more than 5,000 industrial plants, yet there are only 109 separate sources of water pollution. Forty-six sources of pollution are caused by municipal sewage, 17 are caused by institutional sewage, 44 result from the discharge of industrial process wastes and two originate solely from the discharge of sanitary sewage from manufacturing plants having no process wastes.

That there are relatively few sources of municipal sewage pollution is largely because four sewerage systems serve a total of 37 municipalities and each system has only one ocean outfall sewer outlet. These four sewerage systems have a connected population of 1,891,000 persons, 86 percent of the sewered population of the basin and yet they account for only four sources of pollution. The Boston Main Drainage system serves 453,000 persons, 20 percent of the population contributing sewage pollution in the basin; the North Metropolitan District Commission sewerage system serves all or part of 17 suburban communities and part of Boston, the total population served being 713,000 persons, this being 32 percent of the total sewered population of the basin; the South Metropolitan District Commission sewerage system serves 15 neighboring cities and towns and part of Boston and has a connected population of 640,000 persons, another 30 percent of all served by sewers; and the South Essex Sewerage District sewers serve four communities with a total contributing population of 84,000 persons, nearly four percent of all the sewered population.

The number of sources of industrial wastes pollution in this basin is relatively small because most of the industry has been concentrated in the larger cities and towns. The method of disposal of process wastes in these cases has been by connection to municipal sewers. This method of industrial waste disposal has been encouraged by the Massachusetts Department of Public Health and in this basin is the most economical and satisfactory means of eliminating a large number of sources of industrial pollution where there are no deleterious effects on sewers, treatment plant structures, or treatment plant operation.

There are 59 towns, some of considerable size, which have no municipal sewerage systems and several others are only partly served by public systems. Sewage disposal has been by private means in these towns and individual houses are served by cesspools or septic tanks and tile fields. These towns further account for the relatively few sources of municipal sewage pollution in the basin as only 17 have existing sources of pollution.

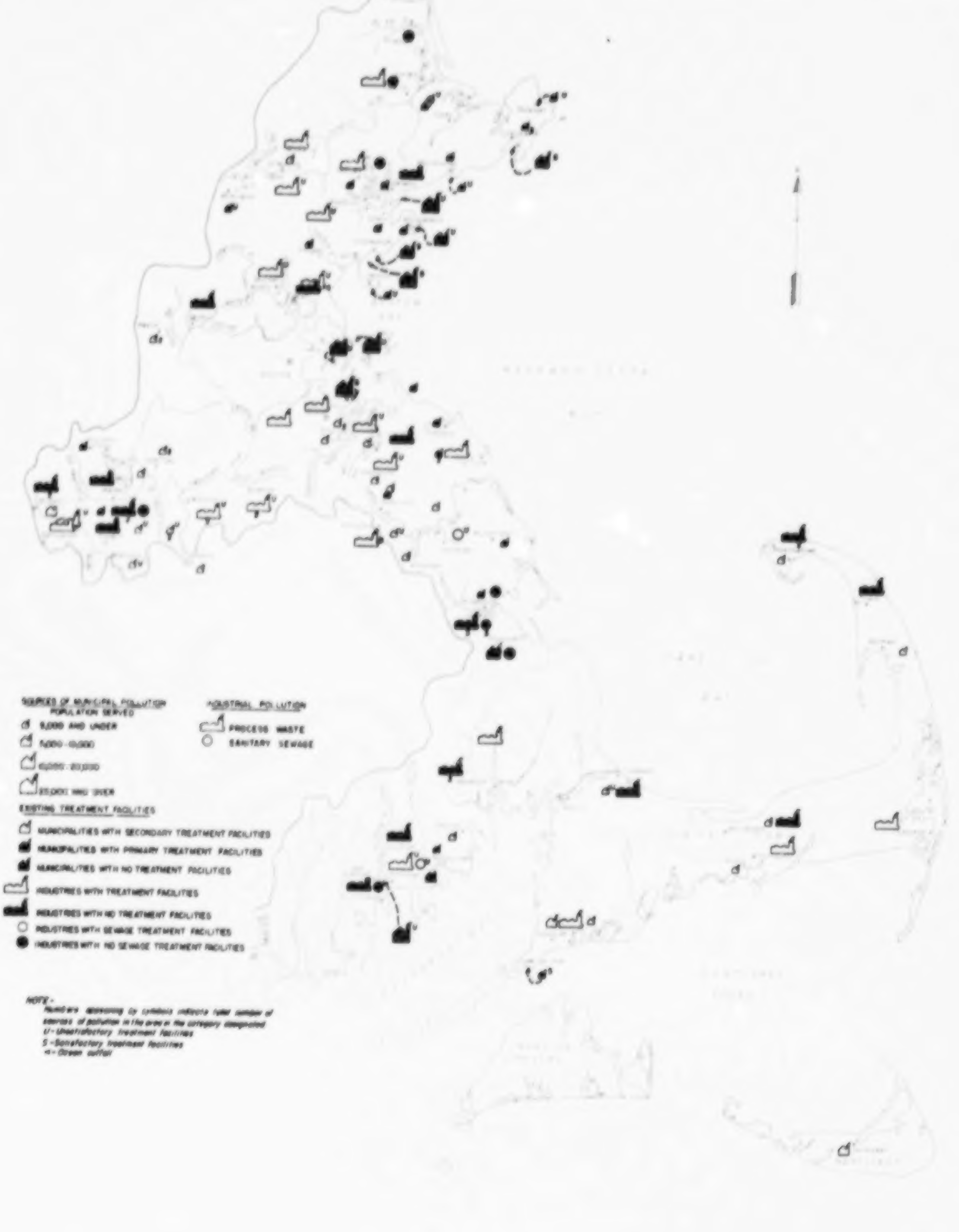
Actually the Metropolitan District Commission sewerage system has more than the two sources of pollution indicated. Several of the trunk sewers are overtaxed in capacity and frequently overflow into nearby watercourses at a number of places. Also, eight of the other sewered communities apart from the Metropolitan District have additional sources of sewage pollution from private outlets in areas not served by the municipal systems.

Although the total number of sources of pollution is comparatively low in this basin, the total pollutional load contributed is very high. The largest amounts of pollution are discharged into the coastal waters which are the area's most economically valuable water resources. The total pollution load of all wastes discharged directly to watercourses in the Massachusetts Coastal Streams Basin daily is computed to have a population equivalent of about 4,056,500 persons. Of this total approximately 55 percent is contributed by domestic sewage and the remainder by industrial process wastes. There is, in addition, considerable pollution caused by inorganic industrial wastes not amenable to computation in terms of population equivalent.

Scattered throughout the basin, and particularly in the southern portion, there are a large number of residences and camps, many having plumbing systems that discharge to private sewers leading into nearby shallow coastal waters or small streams. Most of these individual sources of pollution are too small and scattered to be counted as separate sources of pollution in this report which has been confined to sources contributed to by 30 persons or more in compacted areas. Individually, in relation to the total pollution load discharged in the basin, these small sources of pollution are relatively insignificant. Collectively, however, they represent a real pollution problem to the public health, particularly in recreation areas.

Surveys of the streams and coastal waters of the basin have been made in the past and gaps in existing information have been filled in by surveys recently completed for the purpose of preparing this report. Although additional studies will undoubtedly be required to solve specific pollution abatement problems, thereare sufficient data on hand to demonstrate the need for a comprehensive pollution control program in the Massachusetts Coastal Streams Basin.

Table 5 is a summary of all known sources of water pollution and Map No. 3 shows their approximate locations and distribution. Figure A shows the cities and towns served by the Metropolitan District sewerage systems.


SOURCES OF MUNICIPAL POLLUTION
POPULATION SERVED
5,000 AND UNDER
5,000 - 10,000
10,000 - 20,000
20,000 AND OVER
INDUSTRIAL POLLUTION
PROCESS WASTE
SANITARY SEWAGE
EXISTING TREATMENT FACILITIES
MUNICIPALITIES WITH SECONDARY TREATMENT FACILITIES
MUNICIPALITIES WITH PRIMARY TREATMENT FACILITIES
MUNICIPALITIES WITH NO TREATMENT FACILITIES
INDUSTRIES WITH TREATMENT FACILITIES
INDUSTRIES WITH NO TREATMENT FACILITIES
INDUSTRIES WITH SEWAGE TREATMENT FACILITIES
INDUSTRIES WITH NO SEWAGE TREATMENT FACILITIES
NOTE -
Numbers appearing by symbols indicate total number of sources of pollution in the area in the category designated
U - Unsatisfactory treatment facilities
S - Satisfactory treatment facilities
< - Ocean outfall

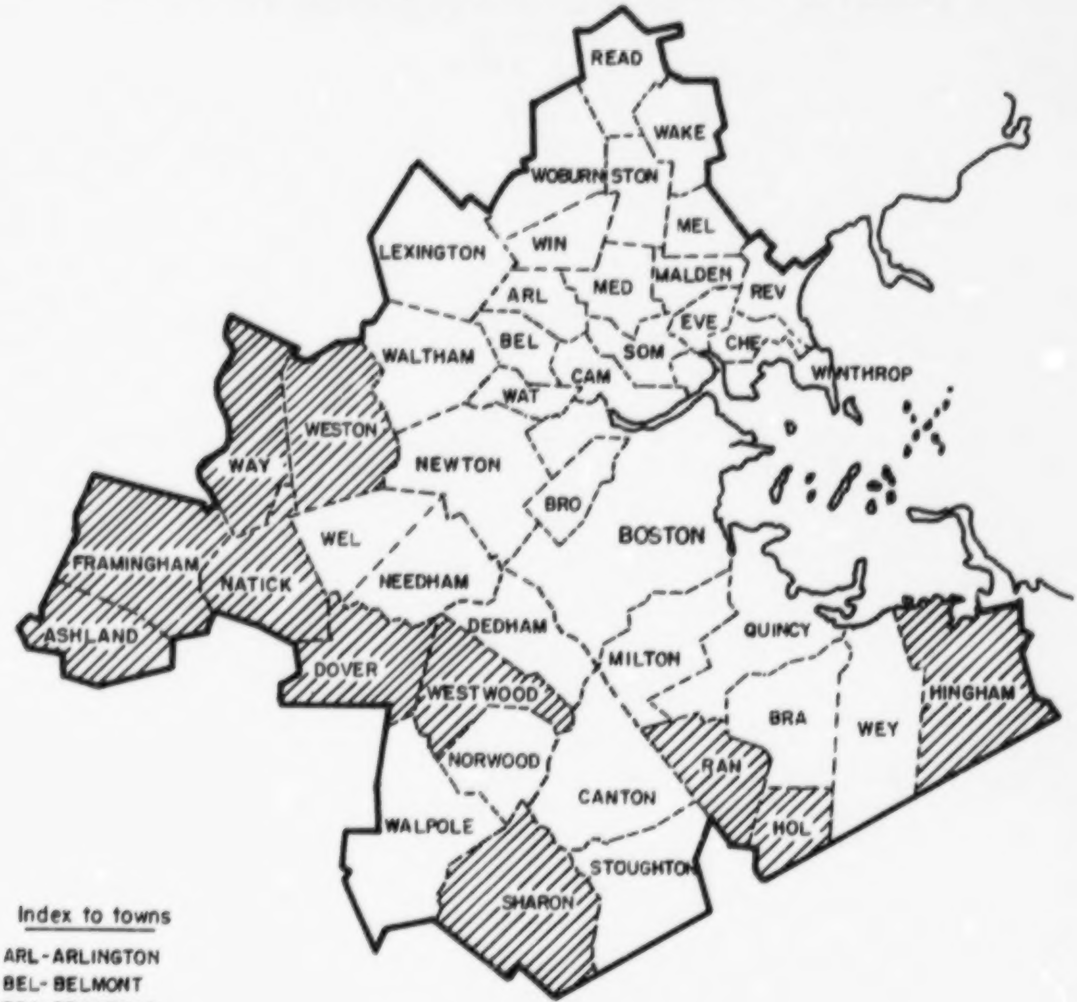
MASSACHUSETTS COASTAL STREAMS BASIN

SOURCES OF POLLUTION
AND
EXISTING TREATMENT WORKS

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 3

ARMY NED BOSTON

CITIES AND TOWNS SERVED BY METROPOLITAN DISTRICT AND BOSTON SEWERS



READ
WAKE
WOBURN
STON
MEL
LEXINGTON
WIN
MALDEN
ARL
MED
REV
EVE
CHE
BEL
SOM
WALTHAM
CAM
WINTHROP
WAT
WESTON
WAY
NEWTON
BRO
BOSTON
WEL
FRAMINGHAM
NATICK
NEEDHAM
DEDHAM
QUINCY
ASHLAND
DOVER
MILTON
WESTWOOD
BRA
WEY
HINGHAM
NORWOOD
RAN
CANTON
HOL
WALPOLE
STOUGHTON
SHARON
SCALE IN MILES
4 0 4

☐ Existing

▨ Proposed

Index to towns

ARL-ARLINGTON
BEL-BELMONT
BRA-BRAINTREE
BRO-BROOKLINE
CAM-CAMBRIDGE
CHE-CHELSEA
EVE-EVERETT
HOL-HOLBROOK
MED-MEDFORD
MEL-MELROSE
RAN-RANDOLPH
READ-READING
REV-REVERE
SOM-SOMERVILLE
STON-STONEHAM
WAKE-WAKEFIELD
WAT-WATERTOWN
WAY-WAYLAND
WEL-WELLESLEY
WIN-WINCHESTER
WEY-WEYMOUTH

Fig. A
MASSACHUSETTS COASTAL
STREAMS BASIN
FEDERAL SECURITY AGENCY
PUBLIC HEALTH SERVICE

56-B

Table 5--Summary of Number and Status of Known Sources of Pollution,
Massachusetts Coastal Streams Basin, 1952

Sources of Pollution	Total No.	Without Treatment			With Treatment			Project Not Needed
		No.	Treatment Needed	Status Not Known	No.	Improvements Needed	Status Not Known	
Institutions	17 1/	0	0	0	17	3	0	14
Municipalities (sewered)	63 2/	32	32	0	32	11	0	21 3/
Villages & Towns (unsewered)	18 4/	16	16	0	1	1	0	0
Industry (sewage only)	2 5/	1	1	0	1	1	0	0
Industry (wastes only)	38 6/	16	14	0	22	15	0	9 7/
Industry (both sewage & wastes)	6 8/	5	5	0	1	0	0	0

1/ Includes 2 colleges and 2 military installations and 4 schools.

2/ Includes 7 municipalities having sewerage systems but have other pollution from private sewers also listed under unsewered towns; includes 37 municipalities served by 4 systems.

3/ Includes 4 communities with satisfactory ocean outfalls and South Metropolitan District which serves 15 communities and part of Boston.

4/ Includes 10 communities without sewerage systems and parts of 8 communities having systems that contribute sewage from 30 persons or more in areas not connected to municipal sewers.

5/ Eight additional industries have their sanitary wastes discharged to ground water.

6/ Includes industries with satisfactory treatment or disposal of sanitary sewage.

7/ Includes two plants listed without treatment where dilution of wastes is considered satisfactory at present.

8/ Four additional plants discharge process and sanitary wastes to ground water, not counted as sources of water pollution.

Pollution Contributed by Municipal Sewage

There are a total of 46 sources of municipal sewage pollution in the Massachusetts Coastal Streams Basin and these contribute by far the most pollution to the water resources. There are nearly 2,190,000 persons residing in 63 communities that are served by a total of 28 separate sewerage systems having outlets directly into watercourses. The 18 other sources of pollution are caused by discharges of untreated sewage from private sewers, septic tanks or cesspools in ten unsewered communities and in eight **municipalities** only partly served by municipal sewerage systems. Domestic sewage from private sources **is** contributed by a total of nearly 8,700 persons. In addition to domestic sewage, the 28 municipal sewerage systems convey the wastes from hundreds of commercial and manufacturing establishments.

The total pollutional load discharged from municipal sources of pollution daily is computed to be equivalent to the wastes from nearly 3,983,000 persons. Of this amount, a population equivalent of about 2,000,000 persons is attributed to domestic wastes and the remaining equivalent of 1,983,000 persons to industrial plants.

Twelve of the sources of municipal pollution are accounted for by effluents from 12 municipal sewage treatment plants that serve approximately 657,000 persons residing in 27 separate municipalities. Eight of the sewage treatment plants serving 652,200 persons provide adequate treatment while the remaining four treatment plants serving 4,800 persons discharge effluents of unsatisfactory quality. The population equivalent of wastes treated in municipal sewage treatment plants discharging effluents to watercourses in this basin total 1,048,250 persons which is reduced by treatment to 517,800 persons. The Nut Island primary sewage treatment works of the South Metropolitan Sewerage District accounts for most of the reduction in pollution as this facility serves 15 municipalities and part of Boston. The Nut Island plant treats wastes having a population equivalent of 1,032,000 **persons** that is reduced to 516,000 persons by screening, sedimentation and chlorination before discharge into Quincy Bay in Boston Harbor.

Two communities with populations totaling 12,600 have sewage treatment facilities in operation with subsurface disposal of effluents that causes no pollution of streams. Another community of 1,000 persons has no sewerage system but has recently completed a municipal sewage treatment project that required satisfactory subsurface disposal of domestic wastes by the individuals responsible. While appearing in the basic data appended to this report, these three communities are not counted as sources of pollution.

The major sources of municipal sewage pollution are discharged into the coastal waters from sewerage systems having ocean outfall sewer outlets. There are 13 ocean outfall sewer outlets in this basin and these serve a total of 48 communities that have a combined population of 2,150,000 and numerous industrial establishments. The population equivalent of municipal sewage discharged into the coastal waters at ocean outfalls is computed to be 3,940,000 persons. Only one of these sewerage systems includes major treatment works for reducing pollution and this is the Nut Island plant of the South Metropolitan Sewerage District system discussed above. Four other ocean outfall sewers serving nine communities with a combined population of 308,650 provide minor treatment such as comminution, screening and/or grit removal. There is no treatment provided for the municipal sewage from 24 communities having a total population of 1,200,000 served by the remaining eight ocean outfall outlets in the basin.

The major sources of pollution in the basin are caused by the discharge of municipal sewage from the North Metropolitan Sewerage District system, the South Metropolitan Sewerage District system, the Boston Main Drainage system, and the South Essex Sewerage District. Pollution of New Bedford Harbor and nearby shores of Buzzards Bay by sewage from Dartmouth, Fairhaven and New Bedford is serious although some recent improvements have been made to the New Bedford sewerage system. Sewage from 9,000 persons in Fairhaven is still discharged into New Bedford Harbor and vicinity without treatment and a pumping station and intercepters are needed in New Bedford to prevent overflows from trunk sewers.

The North Metropolitan District sewerage system, which serves 17 municipalities and part of Boston, discharges untreated sewage from a combined total of 712,980 persons into Boston Harbor near Deer Island Light through multiple outlets. The South Metropolitan District sewers intercept the sewage from 15 communities and a part of Boston, the total population served being 640,980 and discharge into Boston Harbor near Nut Island. The Boston Main Drainage system serves the remaining 453,000 persons in Boston, and the sewage is conveyed to Moon Island where it is discharged into the harbor on the outgoing tide. It is estimated that the total sewage flow entering Boston Harbor from these three sewerage systems, under average conditions of flows, may vary from 170 million gallons to nearly 450 million gallons daily. Only the South Metropolitan System has been provided with adequate treatment by the recently completed Nut Island plant.

In addition to the serious pollution of Boston Harbor from the sewerage systems serving Metropolitan Boston, there is also serious pollution of a number of watercourses within the metropolitan area by overflows from existing trunk sewers of these systems. Parts of all three sewerage systems convey both surface drainage and sewage and all three systems contain certain sections of trunk sewers that overflow on occasion. Under conditions of wet weather, and during the hours of maximum domestic and industrial use, certain of the sewers within these systems discharge into nearby watercourses through exterior overflows.

Within the North Metropolitan District sewerage system, there are 129 exterior overflows leading to more than a dozen streams and to Boston Harbor. The South Metropolitan District sewers have 17 exterior overflows that may discharge into four streams. The Boston Main Drainage system includes 65 exterior overflows that may discharge pollution into harbors, canals, channels and other drainage features of the area. The construction of relief sewers and the provision of a large number of interior overflows within the system have not eliminated exterior overflows under certain conditions.

Not all of the exterior overflows discharge pollution to watercourses. Most of these overflows discharge sewage under extreme conditions of high flow only. A large number overflow only occasionally and a few overflow at frequent intervals. Although there are 211 points where exterior overflows may occur, the State department of health lists only nine that overflow with a regularity that produces nuisances and complaints. These most serious sources of pollution occur in the following streams at the location given:

(South Metropolitan District)

Brighton
Charles River at Babcock Street
Brookline
Muddy River at playground
Newton
Charles River at Charlesbank Road
Quincy
Quincy Bay at manhole off Squantum
Watertown
Charles River at Galen Street
Charles River at U. S. Arsenal

(North Metropolitan District)

Somerville
Alewife Brook at Broadway
Mystic River at North Union Street
Woburn
Aberjona River from Aberjona Valley Sewer

There may be, and probably are, other of the exterior overflows that discharge sewage at fairly regular intervals but they are located where discharges enter streams in non-residential areas or into already polluted watercourses which arouses no comment.

The sewerage systems serving much of Boston and many of the suburbs are very old. All of the older sections of these cities and towns are served by "combined" sewers, carrying both sewage and surface drainage. The problem of intercepting and conveying the sewage and drainage from this metropolitan area has occupied the responsible authorities for many years. As the population to be served increased, the sewerage problems increased. Changes and improvements in the sewerage systems have been made but a real problem of sewage disposal for Metropolitan Boston still exists. This problem is being resolved at the present time as a result of action taken by the General Court authorizing the construction of sewers and treatment works.

Table 6 lists the 46 known separate sources of municipal pollution discharged directly to watercourses and certain data pertinent thereto.

Table 6--Known Sources of Municipal Sewage Pollution,
Massachusetts Coastal Streams Basin, 1952

Community 1/	Number Sewered	Treatment	Status of Treatment 2/	Est. Population Equivalent
Abington (T)	750	Secondary	U	375
Arlington (T)	(42,860)	Served by M.D.C.(North)		
Barstable (T)	250	Secondary	S	25
Belmont(T)	(22,580)	Served by M.D.C.(North)		
Beverly (C)	(22,500)	Served by South Essex Sewerage District		
Beverly (C)	(Private	Sewers)		332
Boston Main Drainage	453,000	None 4/		545,800
Boston (C)	(79,300) (277,820)	Served by M.D.C.(North) Served by M.D.C.(South)		
Bourne (T)				
--Sagamore Apts.	125	Secondary	U	50
Braintree (T)	(8,060)	Served by M.D.C.(South)		
Brookline (T)	(56,940)	Served by M.D.C.(South)		
Cambridge (C)	(120,500)	Served by M.D.C.(North)		
Canton (T)	(1,310)	Served by M.D.C.(South)		
Chelsea (C)	(38,930)	Served by M.D.C.(North)		

Table 6--Known Sources of Municipal Sewage Pollution, Massachusetts Coastal Streams Basin, 1952 (Cont.)

Community 1/	Number Sewered	Treatment	Status of Treatment 2/	Estimated Population Equivalent
Cohasset (T)	(No Municipal System)			850
Danvers (T)	(2,000)	Served by South Essex Sewerage District		
Danvers (T)	(Private Sewers)			220
Dartmouth (T)		Served by New Bedford		
Dedham (T)	(11,740)	Served by M.D.C.(South)		
Everett (C)	(45,500)	Served by M.D.C.(North)		
Fairhaven (T)	9,000	None		9,000
Falmouth (T)				
--Housing Proj.	225	Secondary	S	25
--Woods Hole (V)	150	None 3/		150
Franklin (T)	3,900	Secondary	U	750
Gloucester (C)	18,000	None 3/		60,400
--E. Gloucester	1,000	None		6,000
--Magnolia Sec.	(Private Sewers)			76
Holliston (T)		No Municipal System		100
Hull (T)	2,170	None		2,170
Ipswich (T)		No Municipal System		2,500
--Vet. Housing Project	200	Secondary	S	Negligible
--Old Housing Project	100	Primary; Land Application	U	25
Kingston (T)		No Municipal System		200

Table 6--Known Sources of Municipal Sewage Pollution,
Massachusetts Coastal Streams Basin, 1952(Cont.)

Community 1/	Number Sewered	Treatment	Status of Treat-ment 2/	Estimated Population Equivalent
Lexington (T)	(5,780)	Served by M.D.C.(North)		
Lynn (C)	98,200	None 3/		353,000
Malden (C)	(57,900)	Served by M.D.C.(North)		
Manchester (T)	1,800	None 4/		1,800
Manchester (T)		(Private Sewers)		116
Marblehead (T)	10,800	None 4/		10,800
Marblehead (T)		(Private Sewers)		332
Marion (T)	1,000	Secondary	S	100
Marshfield (T)		No Municipal System		200
Mattapoisett (T)		No Municipal System		400
Medfield (T)	500	Secondary	S	50
Medford (C)	(65,990)	Served by M.D.C.(North)		
Medway (T)	200	None		200
Melrose (C)	(26,850)	Served by M.D.C.(North)		
Milford (T)	9,000	Secondary	S	390
Millis (T)	200	Secondary	S	Negligible
Milton (T)	(19,580)	Served by M.D.C.(South)		
Nahant (T)	2,000	None 4/		2,000
Needham (T)	(7,770)	Served by M.D.C.(South)		
New Bedford (C)	111,000	None 4/		412,000
Newton (C)	(76,140)	Served by M.D.C.(South)		

Table 6--Known Sources of Municipal Sewage Pollution, Massachusetts Coastal Streams Basin, 1952(Cont.)

Community 1/	Number Sewered	Treatment	Status of Treatment 2/	Estimated Population Equivalent
North M.D.C.	712,980	None 4/		1,620,000
Norwood (T)	(14,140)	Served by M.D.C.(South)		
Peabody (C)	(19,700)	Served by South Essex Sewerage District		
Plymouth (T)	11,000	None		11,000
Quincy (C)	(80,200)	Served by M.D.C.(South)		
Reading (T)	(3,970)	Served by M.D.C.(North)		
Revere (C)	(31,790)	Served by M.D.C.(North)		
Rockland (T)		No Municipal System		1,000
Rockport (T)	2,000	None 4/		2,000
Salem (C)	(40,200)	Served by South Essex Sewerage District		
Salem (C)		(Private Sewers)		64
Saugus (T)	4,350	Served by Lynn Outfall Sewer		
Saugus (T)		(Private Sewers)		500
Scituate (T)				
--Scituate (V)		No Municipal System		400
--Scituate Center (V)		No Municipal System		200
Somerville (C)	(102,100)	Served by M.D.C.(North)		
South Essex Sewage District	84,400	Grease removal 4/		406,000
South M.D.C.	640,390	Primary, Chlorination	S	516,000
Stoneham (T)	(10,270)	Served by M.D.C.(North)		

Table 6--Known Sources of Municipal Sewage Pollution, Massachusetts Coastal Streams Basin, 1952(Cont.)

Community 1/	Number Sewered	Treatment	Status of Treatment 2/	Estimated Population Equivalent
Stoughton (T)	(1,110)	Served by M.D.C.(South)		
Swampscott (T)	10,700	None 3/		10,700
Wakefield (T)	(11,650)	Served by M.D.C.(North)		
Walpole (T)	(2,100)	Served by M.D.C.(South)		
Waltham (C)	(33,860)	Served by M.D.C.(North)		
Watertown (T)	(37,270)	Served by M.D.C.(South)		
Wellesley (T)	(12,350)	Served by M.D.C.(South)		
Weymouth (T)	(510)	Served by M.D.C.(South)		
Wilmington (T)		Private cesspools	U	200
Winchester (T)	(15,530)	Served by M.D.C.(North)		
Winthrop (T)	(19,480)	Served by M.D.C.(North)		
Woburn (C)	(12,000)	Served by M.D.C.(North)		
Total	2,189,890 5/			3,982,490

1/ T - Town; V - Village; C - City; M.D.C. - Metropolitan District Commission.
2/ S - Satisfactory; U - Unsatisfactory.
3/ Satisfactory ocean outfall.
4/ Unsatisfactory ocean outfall.
5/ Does not include 8,690 persons served by private sewers.

Sources of Institutional Sewage Pollution

Compared to municipal pollution institutional sewage is a very minor source of pollution. There are 17 significant institutions in the basin, exclusive of those within the city limits of the larger cities and served by municipal facilities. Almost all of the 17 institutions are located on small streams and all have been provided with secondary sewage treatment works. Pollution by institutional sewage, therefore, takes the form of treatment plant effluents, 14 of which are satisfactory and three being unsatisfactory solely because location of the plant requires chlorination of the effluent.

There are 9,360 persons residing or employed in 15 of the institutions and the sewage treatment plants reduce the total pollution load contributed to watercourses to the equivalent of the domestic sewage from about 300 persons. Data on pollutional load from military establishments are not given but all are adequately served by satisfactory secondary treatment plants that produce a high degree of purification.

Table 7, below, lists the sources of institutional sewage pollution in the Massachusetts Coastal Streams Basin together with related data.

Table 7--Sources of Institutional* Sewage Pollution, Massachusetts Coastal Streams, 1958

Institution 1/	Population Served 2/	Treatment	Treatment 3/ Status	Estimated Population Equivalent
Braintree (T)				
--Norfolk Co. Hospital	145	Secondary	S	Negligible
Foxboro (T)				
--State Hospital	1,500	Secondary; Chlorination	S	26
Hanover (T)				
--St. Coletta School	85	Secondary	S	Negligible
Hanson (T)				
--Plymouth Co. Hospital	155	Secondary	S	Negligible
Medfield (T)				
--State Hospital	2,300	Secondary	S	55
Norfolk (T)				
--Pondville Sanitarium	245	Secondary	4/	Negligible
--Prison Colony	900	Secondary	4/	Negligible
North Reading (T)				
--State Sanitarium	165	Secondary; Chlorination	S	Negligible
Rockland (T)				
--Jefferson School	230	Secondary	S	23
--High School	500	Secondary	S	10
Wellfleet (T)				
--Camp Wellfleet	N	Secondary	S	N

Table 7--Sources of Institutional* Sewage Pollution, Massachusetts Coastal Streams, 1952 (Cont.)

Institution 1/	Population Served 2/	Treatment	Treatment 3/ Status	Estimated Population Equivalent
Weymouth (T)				
--Naval Air Station	N	Secondary; Chlorination	S	N
--South Shore Hospital	150	Secondary	S	Negligible
--Homestead School	300	Secondary	S	30
Weston (T)				
--Regis College	475	Secondary	S	24
--Weston College	270	Secondary	S	Negligible
Wrentham (T)				
--State School	1,940	Secondary	4/	Negligible
Total	9,360			168 6/

* Includes significant public and private institutions and schools, and military reservations.

1/T - Town

2/N - Data undetermined.

3/S - Satisfactory; U - Unsatisfactory.

4/Capacity and operation satisfactory but location of plant requires chlorination of effluent.

5/P.E. - Population equivalent in terms of biochemical oxygen demand.

6/Does not include military reservations and effluents contributing negligible pollution.

Pollution Contributed by Industry

There are 46 sources of industrial pollution discharged directly into watercourses in the Massachusetts Coastal Streams Basin. Forty-four sources of pollution are caused by the discharge of industrial process wastes and 2 plants that produce no process wastes but discharge sanitary sewage from employees. Six manufacturing plants producing process wastes also discharge untreated employee sewage but each is tabulated as only one source of pollution.

There are 21 manufacturing plants discharging untreated process wastes directly to streams. All of the plants produce organic wastes except six. Five sources of pollution are caused by textile mill processing wastes, three by laundry wastes, four by metal processing and 9 by miscellaneous manufacturers of chemicals, hats, foods, etc. Ten of the plants having organic wastes contribute pollution equivalent in strength to the domestic sewage from 17,000 persons. Five plants that process fish during the summer months have no data available on strengths of wastes. The wastes from the six plants discharging inorganic wastes cannot be computed in terms of population equivalent.

In addition to the pollution caused by the discharge of untreated process wastes, industry contributes considerable pollution to the small streams of the basin in effluents from industrial waste treatment plants. There are 23 industrial waste treatment plants in operation at the present time. Only six of these treatment facilities are satisfactory, 17 being inadequate in capacity and design. Sixteen of the treatment plants are designed for organic process wastes and seven treat inorganic wastes.

Industrial waste treatment facilities discharge effluents from treating tannery, chemical manufacturing, paper manufacture, textile processing, commercial laundry and slaughterhouse wastes, and wastes from processing metals, fish and other food products. The pollutional strengths of effluents from industrial facilities treating organic wastes is equivalent to a population of 55,400 persons.

Another form of significant pollution from industry arises from the discharge of employee sewage to watercourses. Eight manufacturing plants discharge untreated sanitary sewage from a total of 3,350 employees and one plant discharges sewage from 475 employees after inadequate treatment.

All of the known sources of industrial wastes discharged directly into the water resources, together with available data on employee sewage, are presented in Table 8. The names of manufacturing establishments are not given in accordance with the established policy of the Massachusetts Department of Public Health. Instead, the location of sources, the type of wastes produced and the status of treatment are given.

Table 8--Sources of Industrial Waste and Sewage Pollution, Massachusetts Coastal Streams Basin, 1952

Receiving Watercourse	Plant Location 1/	Types of Wastes Discharged	Treatment Status 2/	
			Process Wastes	Sewage
Ipswich River	Middleton (T)	Chemical	Satis.	Satis.
	Ipswich (T)	Sewage	--	None
Lubber Brook	N. Wilmington (Wilmington town)	Tannery	Unsat.	Satis.
North River	Peabody (C)	Chemical	Unsat.	--

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Table 8--Sources of Industrial Waste and Sewage Pollution, Massachusetts Coastal Streams Basin, 1952

Receiving Watercourse	Plant Location 1/	Types of Wastes Discharged	Treatment Status 2/	
			Process Wastes	Sewage
Danvers River	Danvers (T)	Tannery	Satis.	--
Bass River	Beverly (C)	Metals	None 3/	--
Mystic River	Everett (C)	Coke by-product	Unsat.	Satis.
	Everett (C)	Artificial gas	Unsat.	Satis.
	Everett (C)	Tar refining	Unsat.	Satis.
	Everett (C)	Chemical	None	--
	Everett (C)	Oil refining	Unsat.	Satis.
Malden River	Malden (C)	Artificial gas	Unsat.	--
Charles River	Milford (T)	Rubber-coated textile	None	--
	Milford (T)	Hat dying	None	--
	Bellingham (T)	Wool scouring	Satis.	Satis.
	Bellingham (T)	Woolen textile	Unsat.	Satis.
	Medway (T)	Woolen textile	None	None
	Medway (T)	Laundry	None	Satis.
Mine Brook	Franklin (T)	Felt textile	None	--
Unnamed Brook (Charles Basin)	Millis (T)	Asphalt shingles	None	--
Neponset River	Walpole (T)	Paper mill	Unsat.	--
	Walpole (T)	Paper mill	Unsat.	--
	Hyde Park (Boston city)	Paper mill	Satis.	--
Canton River	Canton (T)	Fowl slaughtering	Unsat.	Satis.
	Canton (T)	Rubber processing	Unsat.	Satis.

Table 8--Sources of Industrial Waste and Sewage Pollution, Massachusetts Coastal Streams Basin, 1952 (Cont.)

Receiving Watercourse	Plant Location 1/	Type of Wastes Discharged	Treatment Status 2/	
			Process Wastes	Sewage
Quincy Bay	Quincy (C)	Detergent mfg.	Satis.	--
Weymouth Fore River	Weymouth (T)	Dairy	Unsat.	Satis.
Weymouth Back River	Weymouth (T)	Wool scouring	None	Satis.
Mill River (Weymouth Back)	Weymouth (T)	Laundry	Unsat.	Satis.
Satuit Brook	Scituate (T)	Laundry	Satis.	Satis.
North River	Abington (T)	Ice cream	Unsat.	Satis.
Jones River	Kingston (T)	Woolen textile	None	None
	Kingston (T)	Laundry	None	None
Smelt Brook	Kingston (T)	Metal plating	None	None
Plymouth Harbor	Plymouth (T)	Sewage	--	None
Wareham River	Wareham (T)	Laundry	None	Satis.
	Wareham (T)	Nail mfg.	None 3/	Satis.
Acushnet River	Acushnet (T)	Rubber products	None	Satis.
	New Bedford (C)	Copper mill	None	None
Buzzards Bay	Fairhaven (T)	Metal plating	Unsat.	Unsat.
Cape Cod Canal	Bourne (T)	Cranberry proc.	None	Satis.
Cape Cod Bay	Barnstable (T)	Cranberry proc.	None	Satis.
	Truro (T)	Fish processing	None	Satis.
	Provincetown(T)	Fish processing	None	Satis.
	Provincetown(T)	Fish processing	None	Satis.
Pleasant Bay	Chatham (T)	Laundry	Unsat.	Satis.

Footnotes on following page.

1/ T - Town; C - City.
2/ Satis. - Satisfactory treatment facility; Unsat. - Unsatisfactory treatment facility; None - No treatment facilities provided; -- Indicates no wastes discharged to watercourse.
3/ Dilution satisfactory disposal for the present.

Pollution Resulting from Soil Erosion

Soil erosion presents no water pollution problems in the Massachusetts Coastal Streams Basin. For the most part, the interior regions are covered by grass or woodland and there is little evidence of erosion. In the town of Essex, there is some severe wind erosion and there are extensive eroded areas on Cape Cod, and the islands to the south. There has also been extensive wind and wave erosion along the shoreline.

Pollution Contributed by Trash Disposal

There are evidences of the use of streams for the disposal of trash and sometimes garbage. The practice is principally confined to householders, business establishments and others located on properties abutting, or convenient to, streams. In terms of population equivalent this type of pollution contributes little to the impairment of downstream water qualities. It does, however, materially reduce the visual aesthetic quality of the watercourses.

Section 10

DAMAGES TO WATER RESOURCES FROM POLLUTION

General

The inland water resources of the Massachusetts Coastal Streams Basin are not extensive and consist of some 21 streams that could be considered of any significance. The largest of these streams is the Charles River which has an average annual discharge into Boston Harbor of only 320 cubic feet per second. The average annual run-off from all of the basin is computed to be about 3,400 cubic feet per second. When it is considered that the basin contains more than 2,650,000 residents and more than 5,000 manufacturing establishments it is indicated that the fresh-water resources are rather limited.

The basin has extensive resources in its coastal waters and the Commonwealth can boast of more than 2,000 miles of shoreline. The coastal waters have been extensively developed for recreation and make important navigation, maritime commerce and shellfish industry activities possible. The coastal waters are undoubtedly the most extensive and important of the basin's water resources.

Most of the pollution originating in the basin is contributed to the coastal waters through ocean outfall sewers but, considering the small size and low recovery characteristics of the streams, there is also an appreciable pollution of the inland water resources. Most of these small streams have little fall and their flows are sluggish and affected by tidewater. Some of these streams are also subject to periods of low flow and run-offs may approach zero during periods of even short droughts.

Of the 21 streams of any size, 13 have main stems or tributaries, or both, that have been damaged by pollution. It is estimated that 40 miles of the shore waters are damaged significantly by pollution and this does not include the tidal estuaries of streams which in this report are considered to be a part of the appropriate watercourses. Damages have been greatest to the water resources serving the Boston Metropolitan area.

Damages to the Fresh-Water Resources

Thirteen of the streams and/or their tributaries are significantly damaged by pollution. Damages have been most serious to the water resources of the Charles, Saugus, Neponset, Mystic, Weymouth Back, James, North (Scituate-Marshfield towns), Jones, Danvers, Ipswich and Acushnet River Basins. There are main stems of two rivers and 10 tributaries to other rivers that receive minor pollution that causes no damages to downstream water uses.

The principal uses made of these water resources are for public water supply, industrial water supply, livestock watering, game fishing, bathing, other associated forms of recreation, shellfish propagation, power development and transportation of sewage and industrial process wastes. Conflicts between these various uses are relatively minor with the exception of transportation of sewage and wastes which, in the principal rivers, seriously impairs water qualities for other desired and normal uses. The most serious conflicts are between the use of streams for transportation of wastes and the uses for all types of water recreation and for shellfish propagation. The conflict between pollution and recreation is most serious in Metropolitan Boston where day-use of recreational facilities is most important and most needed.

The damages to the fresh water resources are caused by the untreated and inadequately treated sewages from 13 communities and institutions that have a total pollutional load equivalent to the domestic sewage from more than 14,200 persons; by the sanitary wastes, untreated and unsatisfactorily treated, from over 3,800 manufacturing employees; by the untreated municipal sewage from overflowing sewers serving Metropolitan Boston and by the untreated and inadequately treated process wastes of 32 manufacturing establishments that have a population equivalent of about 60,000 persons.

Damages to fresh water resources from pollution extend from minor pollution that prohibits uses for recreational bathing to gross pollution that creates nuisance condition.

The 13 separate watersheds that receive pollution within their drainage systems have main stems and principal tributaries that total a watercourse length of about 257 miles. Of the watercourse miles within these drainage areas, 138 miles receive only minor or no pollution and the waters are of good bacteriological and chemical quality, suitable for all legitimate purposes except public water supply without disinfection; 63 miles are polluted sufficiently to render the waters unsuitable for public water supply except with adequate filtration and disinfection, for recreation uses except boating, for some industrial processes without treatment, for irrigation of crops consumed without cooking and these waters may not always be of good aesthetic quality; about 29 miles are rather seriously damaged and suitable only for transportation of wastes, power development and limited industrial purposes; and the remaining 31.5 miles are seriously damaged and are in nuisance condition, not suitable for any legitimate purpose except power development.

The above damages to water qualities have not been determined quantitatively. Several of these watersheds have been the subject of intensive study for a number of years. Some detailed surveys have been made by the State Department of Public Health which has also routinely analyzed samples of water taken from the more polluted watercourses and investigated many complaints of nuisances caused by pollution. The Department has also cooperated in development of many of the water resources and inspects and samples public bathing waters. The extent of damages to water quality from pollution is related, of course, to the kinds and amounts of pollution and to the size and characteristics of receiving streams. Much of these data are available and sufficient information and experience is at hand for the Department of Public Health to make a reasonable estimate of present damages to water quality from pollution.

It is not practicable to present a detailed discussion of each of the streams damaged by pollution in the Massachusetts Coastal Streams Basin. These data are probably more clearly understood when concisely presented in tabular form and by the use of maps. Table 9 is a summation of damages to water quality of each of the 18 streams and their tributaries transporting pollution. The name of the watercourse, a summary of pollution contributed, the estimated damages to water quality, and the lengths of streams affected during average conditions of flow and pollution are given. The main stems of streams are indicated by (main stem) and the sub-basins of tributaries are given in parentheses.

It should be understood that the damages to water quality as given are, in the absence of complete quantitative data, relative and approximated. The miles of watercourse given represent the estimated lengths of streams damaged or undamaged by pollution during average conditions of run-off, water temperature and pollution contributed in the best judgment of the State Department of Public Health. There is much of the year when damages from pollution are less than indicated, just as there are periods of critical low flows and high water temperatures when damages are greater than shown. Damages are indicated as to suitability of the waters for use although all such uses may not be made at the present time.

Map No. 4 shows these data in more graphic form as the status of present stream conditions. Not shown in Table 9 are the miles of streams in protected watersheds set aside for use as public water supply. Without exception, these protected streams are off the main stems and principal tributaries of the rivers shown. There are 21 public surface water supplies derived from the resources of the basin and while the length of streams in protected watersheds is not known, it is estimated that their total milenge is less than 100 miles.

Table 9 - Damages to Quality of Water Resources
Resulting from Pollution,
Massachusetts Coastal Streams Basin, 1952

Key to Symbols

A - No damages. Waters protected from pollution and used for public water supply only.

B - No damages. Waters transporting no pollution or that have recovered from pollution. Unsuitable for public water supply without treatment. Suitable for all other normal water uses.

Table 9 - Damages to Quality of Water Resources Resulting from Pollution, Massachusetts Coastal Streams Basin, 1952 (Cont.)

Key to Symbols

C - Damaged. Unsuitable for use as public water supply except with adequate filtration and disinfection; for recreational uses except boating; for some industrial processes without treatment; and for irrigation of crops consumed without cooking. Not always of suitable aesthetic quality. Suitable for boating, irrigation of crops consumed after cooking; some industrial uses without treatment; and habitat for wildlife and common food and game fish indigenous to the region.

D - Damaged. Unsuitable for most water uses. Suitable only for transportation of sewage and industrial waste without nuisance and for power development and limited industrial purposes. Aesthetic quality poor.

E - Damaged. Unsuitable for all water uses except power development. Nuisance conditions prevail continuously or during critical periods of low flows and high temperatures.

* - Public water supplies exist on small tributaries of the main stems of streams indicated but mileage is not known.

Watercourse	Damages Resulting from Discharge Of--	Damages and Extent in Miles				
		A	B	C	D	E
Ipswich River (main stem)	Untreated domestic sewage from private sewers of 2,000 persons; secondary treatment plant effluent from two housing projects with total population equivalent of 35 persons; secondary treatment plant effluent of a chemical plant; and pollution transported by 3 tributaries.	0*	28	1	3	0
		(Approximately 16 miles of "B" water used for public supply by Salem-Beverly and Lynn-Peabody)				
Lubber Brook (Ipswich Basin)	Unsatisfactory secondary effluent from a tannery.	0	5.5	0	1.5	0
Martin's Brook (Ipswich Basin)	Overflowing private cesspools serving 300 persons, secondary effluent from State Sanitarium with a negligible population equivalent.	0	3	1	0	0
Farley Brook (Ipswich Basin)	Untreated sewage from private outlets serving 500 persons in Ipswich.	0	0	0	0	0.5
North River (Beverly Harbor)	Inadequately treated chemical plant wastes.	0*	0	3	0	0

Table 9 - Damages to Quality of Water Resources Resulting from Pollution, Massachusetts Coastal Streams Basin, 1952(Cont.)

Watercourse	Damages Resulting from Discharge Of-	Damages and Extent in Miles				
		A	B	C	D	E
Danvers River (Beverly Harbor)	Sewage from private outlets in Beverly and Danvers; pollution transported by two tributaries.	0	0	2	0	0
Bass River (Danvers Basin)	Untreated chemical wastes from plant in Beverly.	0	2	1	0	0
Porter River (Danvers Basin)	Treated tannery wastes and sewage from employees of 1 plant.	0	2	1	0	0
Saugus River (main stem)	Sewage from private outlets from an estimated 500 persons.	0	10	2	0	0
Mystic River (main stem)	Inadequately treated industrial wastes from a coke oven plant, tar refinery and an oil refinery; overflowing municipal sewers at Somerville; pollution transported by four tributaries.	0*	0	7	0	0
Island End R.	Wastes from oil refinery, tar refinery and coke plant	0	0	0	0	1
Malden River (Mystic Basin)	Untreated gas manufacturing wastes.	0	2	2	0	0
Aberjona River (Mystic Basin)	Overflowing municipal sewers in Woburn.	0	3	2	2	0
Alewife Brook (Mystic Basin)	Overflowing municipal sewers in Somerville.	0	2	0	1	0
Charles River (main stem)	Untreated domestic sewage from 200 persons; secondary effluent from 3 municipal plants and one institutional with a total population equivalent of 497 persons; overflowing municipal M.D.C. sewers at Watertown, Waltham and Boston; primary effluent from one textile mill; intermediate effluent from a wool scouring plant; untreated wastes from a woolen mill, laundry, hat manufacturing plants and rubber-coated fabric mill; pollution transported by 6 tributaries.	0*	44	9	12	0

Table 9 - Damages to Quality of Water Resources
Resulting from Pollution,
Massachusetts Coastal Streams Basin, 1952(Cont.)

Watercourse	Damage Resulting from Discharge Of--	Damages and Extent in Miles				
		A	B	C	D	E
Mine Brook (Charles Basin)	Secondary effluent from municipal plant, population equivalent 390 persons; untreated felt mfg. wastes.	0	2.5	5.5	0	0
Unnamed Brook (Charles Basin)	Untreated wastes from asphalt shingle manufacturing plant.	0	0.5	0	0	1
Stop River (Charles Basin)	Secondary effluents from 3 institutions.	0	1	7	0	0
Bogastow Brook (Charles Basin)	Sewage from private outlets in Holliston	0	3	3	0	0
Neponset River (main stem)	Secondary effluent from an institution; primary effluent from two paper mills (white water only); minor effluent from paper mill (white water only); pollution transported by one tributary.	0	0	7.5	0	20.5
East Branch (Neponset Basin)	Primary effluents from two industrial plants, one a slaughterhouse, the other a rubber processing plant.	0*	0	2	0.5	0
Weymouth Back River (main stem)	Untreated industrial wastes from wool scouring plant; unsatisfactorily treated laundry wastes.	0	2.5	0	0	1.5
James River (main stem)	Sewage from private outlets serving 850.	0	1	0	0	.5
Satuit Brook (main stem)	Private sewer outlets in Scituate serving 200 persons.	0	0	0	0	2
Indian Head River (North Basin)	Pollution transported by tributaries.	0	4	1	0	0

Table 9 - Damages to Quality of Water Resources
Resulting from Pollution,
Massachusetts Coastal Streams Basin, 1952(Cont.)

Watercourse	Damage Resulting from Discharge Of--	Damages and Extent in Miles				
		A	B	C	D	E
French Stream (North Basin)	Untreated sewage from 400 persons in Rockland; unsatisfactory effluent from plant serving 750 persons in North Abington; secondary effluent from military establishment; unsatisfactory treated wastes from ice cream plant.	0	2	4	2	1
Unnamed Brook	Untreated sewage from 600 persons in Rockland.	0	1.5	0	0	2.5
Pudding Brook (North Basin)	Sanitary sewage from 30 employees of one factory.	0	1.5	1	0	0
Jones River (main stem)	Untreated industrial wastes from one woolen mill and one laundry.	0	5	0	3	0
Halls Brook (Jones Basin)	Sewage from private outlets serving 200 persons in Kingston; sanitary wastes from one manufacturing plant.	0	1	0	.5	0
Smelt Brook (Jones Basin)	Untreated acid wastes plus employee sewage from one plant.	0	1	0	.5	0
Acushnet River (main stem)	Untreated domestic sewage from 9,000 persons in Fairhaven; overflowing sewers in New Bedford; wastes from copper plant; and wastes from rubber goods manufacture.	0*	5	0	3	0
Wareham River (main stem)	Wastes from one nail manufacturing plant and from one laundry	0	6	1	0	0
	TOTAL		138.	63.	29.	31.5

Damages to Coastal Water Resources

The coastal waters of the Massachusetts Coastal Streams Basin are subjected to a large volume of sewage pollution. The coastal waters are extensively used for recreation, navigation, shellfishing and sewage disposal. The volume of water available for dilution is so great that there are limited conflicts between sewage disposal and other water uses along most of the shoreline.

There are 13 ocean outfall sewers along the coast that daily discharge the domestic sewage from more than 2,150,000 persons and the industrial wastes from hundreds of manufacturing plants. A total of 48 municipalities are served by these 13 ocean outfalls and the combined municipal wastes have a total population equivalent of 3,940,000 persons. This method of disposal is satisfactory at five outfalls serving seven municipalities with combined populations of about 772,000 and wastes with a population equivalent to watercourses of 940,000 persons. The eight ocean outfalls serving 1,378,000 persons in the remaining 42 municipalities are not satisfactory. These latter communities have wastes with population equivalents totaling 3,000,000 persons and contribute most to damages to other water uses.

In addition to pollution discharged at ocean outfall sewers, the coastal waters are polluted by wastes transported by coastal streams emptying into harbors, by private sewer outlets discharging into shallow coastal waters, and by trash and refuse thrown or pumped from vessels.

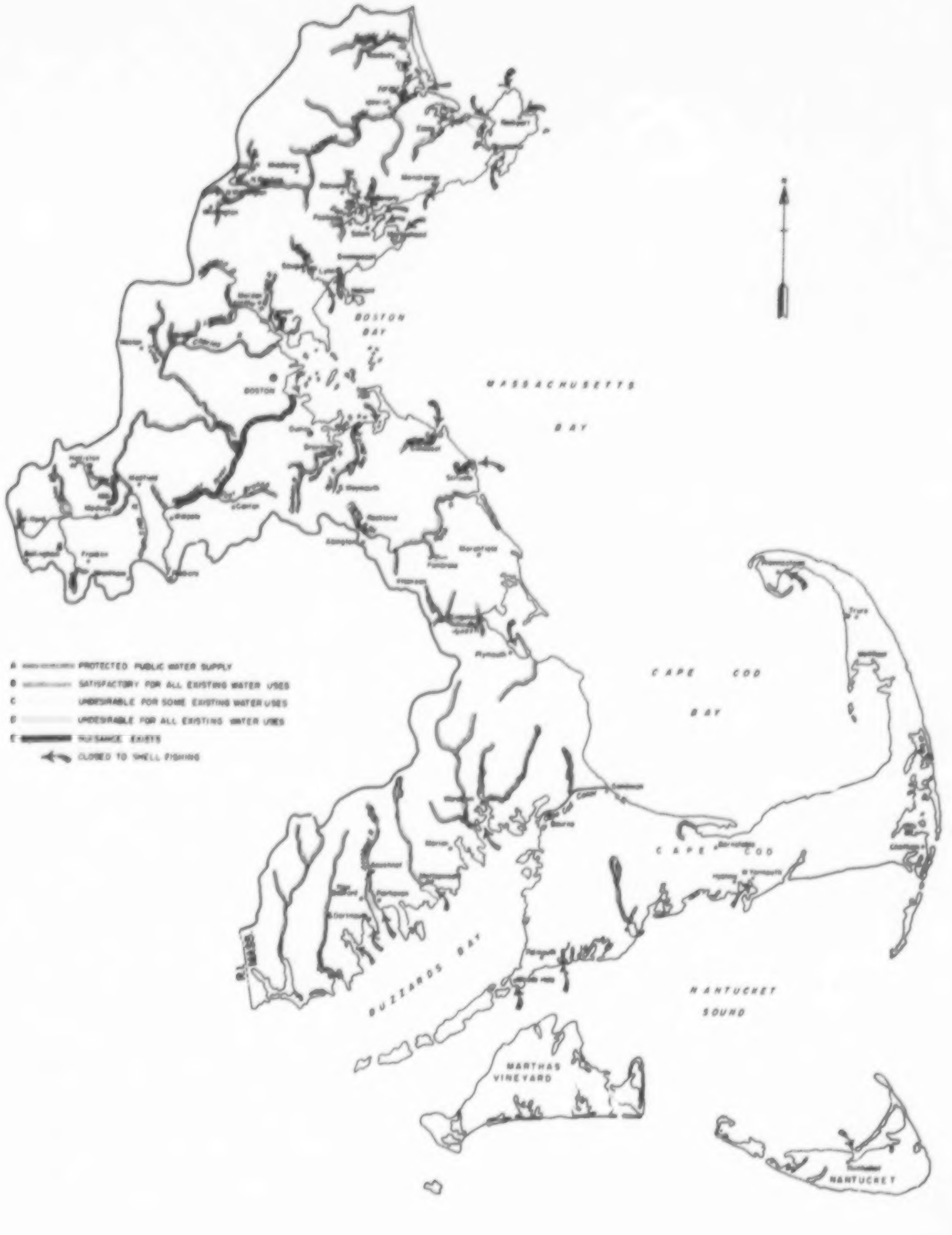
Pollution of coastal waters has caused the condemning of hundreds of acres of clam flats along the entire coastline. There are other clam flats more remotely removed from contamination from which clams may be harvested but these must be treated in a purification plant before sale. Pollution has caused the closing of clam flats, greatly decreasing the annual harvest, in the harbors of, or in the vicinity of, the following municipalities:

Ipswich
Gloucester
Rockport
Manchester
Salem
Plymouth
Marblehead
Woods Hole
Quincy

Weymouth
Hingham
Hull
Cohasset
Kingston
Danvers
Hyannis
Boston
Wareham

Mattapoisett
Fairhaven
New Bedford
Dartmouth
Beverly
Provincetown
Lynn
Nantucket

Although a tremendous volume of sewage and industrial wastes is discharged into the coastal waters, there are no developed areas where pollution has damaged the bacterial quality of water for recreational bathing. The State Department of Public Health routinely inspects public bathing beaches and analyzes samples of the bathing waters. None has been found to be contaminated by sewage organisms in an amount to exceed the State health department's standards for a safe bathing water. There has been a damage to ocean bathing facilities, however, for which sewage pollution is responsible. There have been nuisances created at various times by the deposition of grease balls, oils and other floating debris of sewage origin on the beaches along the North Shore and in Boston Harbor. The deposits cause nuisances that result in large numbers of complaints and which cause reduced attendance at beaches. There are many persons who refuse to patronize these beaches


A PROTECTED PUBLIC WATER SUPPLY
B SATISFACTORY FOR ALL EXISTING WATER USES
C UNDESIRABLE FOR SOME EXISTING WATER USES
D UNDESIRABLE FOR ALL EXISTING WATER USES
E NUISANCE EXISTS
CLOSED TO SHELL FISHING
BOSTON BAY
MASSACHUSETTS BAY
BOSTON
CAPE COD BAY
CAPE COD
NANTUCKET SOUND
BUZZARDS BAY
MARTHAS VINEYARD
NANTUCKET
Plymouth

SCALE OF MILES

78-a

MASSACHUSETTS COASTAL STREAMS BASIN

PRESENT STREAM CONDITION

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO 4

ARMY NED BOSTON

subject to nuisances from deposits of sewage origin even though the waters are declared safe for bathing by the health authorities.

The pollution of coastal and harbor waters causes considerable damage to both commercial and pleasure watercraft. The products of pollution contribute greatly to the fouling of ships' bottoms and the destruction of painted surfaces thereby considerably increasing maintenance costs to owners. There are hundreds of boats of all types and sizes that make extensive use of the harbor and coastal waters and the damages incurred through increased maintenance costs total no small amount. Pollution of harbor waters undoubtedly contributes to the deterioration and the maintenance costs of valuable shore installations. In Boston Harbor, accumulations of oils, tars and greases under piers and other waterfront structures have created a potential fire hazard to millions of dollars worth of properties. On other occasions, pollution by industrial wastes containing phenolic substances has caused the destruction of captive lobsters valued at thousands of dollars.

Damages to coastal waters have been greatest in Boston Harbor which receives most of the pollution originating in the basin. The Harbor waters receive the untreated sewage from the North Metropolitan Sewerage District and the Boston Main Drainage System. Until very recently the South Metropolitan Sewerage District discharged raw sewage into the harbor. In addition to outfall sewers, the harbor is polluted by wastes transported into it by the Mystic, Charles and Neponset Rivers, all being seriously damaged by pollution. Sewage discharged directly into Boston Harbor is contributed by nearly 1,807,000 persons residing in 33 communities in the metropolitan area. Combined with this municipal sewage are the process wastes from a large number of manufacturing plants. The total pollutional load now being discharged into Boston Harbor has a population equivalent in excess of 2,680,000 persons.

The amount of pollution entering Boston Harbor has caused the closing of almost all of the 2,000 acres of clam flats in the harbor and any clams harvested where this is permitted must be chlorinated at a cost of about $1.25 per barrel. The harbor contains anchorage areas for large numbers of ships, boats and yachts and pollution fouling bottoms and deteriorating painted surfaces considerably adds to maintenance costs.

Pollution of Boston Harvor has limited the number of areas that could reasonably be considered for development into bathing beaches. Although the bacterial quality of waters at existing beaches is of satisfactory bacterial quality for safe bathing under State health department standards, nuisances created by floating matter of sewage origin have considerably reduced the popularity and patronage of beaches. Large numbers of persons are caused to seek bathing privileges elsewhere at added cost to the individual. Complaints from sewage-caused nuisances in Boston Harbor have been of the greatest frequency in the Massachusetts Coastal Streams Basin.

The pollution of Boston Harbor has presented a serious problem over many years. In January 1952 the Nut Island treatment plant was placed in operation to serve the South Metropolitan Sewerage District. While this report has been in preparation the General Court has authorized construction of treatment works to serve the North Metropolitan Sewerage District and the Boston Main Drainage System.

Water Resources Undamaged by Pollution

In addition to the 138 miles of undamaged main stems and principal tributaries of streams that transport pollution there are nine other streams of some size whose main stems receive very minor or no pollution and are therefore undamaged. Three of these small rivers are located in the northern part of the basin and the remaining six drain the southern portions. The names of these streams and the approximate lengths of their main stems which total 107 miles are as follows:

Name of Watercourse	Approximate Lenth of Main Stem in Miles
Parker River	15
Essex River	4
Weymouth Fore River	7
North River	11
Wewoantic River	15
Mattapoisett River	11
Slocum River	12
East Branch Westport River	17
West Branch Westport River	15

There is a total of some 240 miles of watercourses of any size in the Massachusetts Coastal Streams Basin that are undamaged by pollution and suitable for all normal water uses except public water supply without treatment. Most of the streams that receive no pollution are very small and most have watersheds of considerably less than 100 square miles. Small as these watersheds may be, their water resources are important to recreation, livestock watering, wildlife, and potential development for public water supplies.

Losses from Damages to Water Resources from Pollution

Losses from damages to the water resources from pollution in the

Massachusetts Coastal Streams Basin have been both real and intangible. The tabulation of specific cases where there have been economic losses brought about by pollution is not wholly possible. Although such losses are known to have occurred, they are seldom brought to the attention of the Massachusetts Department of Public Health, the proper State water pollution control agency. From long experience in the field of water resources and knowledge of the region, however, the Department is aware that pollution has resulted in significant damages to the economy and welfare of the residents and exists as a potential hazard to the public health.

Manufacturers seldom report losses from pollution of sources of process waters. There are an appreciable number of manufacturing plants that utilize streams for process waters. Pollution has required some of these plants to install expensive water treatment equipment, to develop costly ground water supplies or to purchase water from municipal supplies to procure adequate process waters. In addition to the capital investments made for these water facilities made necessary by pollution, there are continuing operational expenditures for materials and personnel. There are occasions, in industries requiring controlled qualities of process waters, when untreated or inadequately treated polluted process waters cause loss of product or increased production costs to recover damaged goods.

Industrial establishments can and do experience a loss from pollution of water resources that is less tangible, but no less significant, than increased production costs or loss of products. Manufacturing plants that are known to contribute damages from pollution of water resources needed or wanted for other legitimate uses suffer a loss in good public relations that may be considerably more costly than may appear at first to be significant. Industry has for some time known that expenditures for good public relations are proper additions to the cost of production of goods. There seems little doubt that good public relations are important and represent a commodity of rapidly-rising value on today's business market.

Owners of residential and industrial real estate do not usually report losses from depreciation of property values due to pollution of abutting streams and coastal waters or the failure to rent, lease or sell such properties located on polluted water resources even though such losses have been very high in this region. Industrial real estate located along polluted streams will not be attractive to new or continued investments in manufacturing that require process waters of good quality and the value of such property is thereby lowered. Residential real estate that includes water recreation facilities or privileges, or even a view of water, generally commands a premium price. When pollution damages or eliminates these aesthetic and recreational advantages, the value of such properties is appreciably lowered. This is particularly true in this area of limited water resources where the general public is unusually anxious to obtain properties located on or having access to water.

The residents of this basin are among the most water recreation-conscious groups in the Nation and the value of the land-water resources for recreational development is probably not matched by any other area of equal size. It probably would not be difficult to show that recreation is the most valuable and economic land-water use. Land abutting on potential recreation waters, or having privileges of access thereto, has a very high value in this basin. When pollution eliminates or deteriorates the recreational value of such water, the land values are reduced accordingly.

Studies have been made which tend to prove that residential properties located on polluted waterways almost always deteriorate into a slum or substandard neighborhood, and some of these studies have been made in New England. These studies further indicated that if a polluted stream could be cleaned to provide even limited swimming, fishing and boating, the areas abutting the streams would become among the better residential districts. There are a large number of residential and industrial properties in Metropolitan Boston whose values have been deteriorated by pollution of abutting water resources that resulted in loss of their use or lowered aesthetic values. It is estimated that this loss from pollution may run well into the millions of dollars. If these data are ever made available, the cost of damages to real estate values resulting from pollution of the water resources may well prove to be the largest loss resulting from this cause.

Still further losses to residential and industrial properties have been caused by the destruction of exterior painted surfaces through the action of hydrogen sulfide generated in nearby sewage-polluted waters. In some cases, these losses have been borne by the individual and in others they have been paid by the municipality or sewage authority responsible for the damages.

There has been considerable damage to shore installations and watercraft due to pollution of harbor waters. Owners of such properties pay increased maintenance costs because of the fouling of equipment and hulls by oils, greases and sewage matters. The harbors of the basin serve as anchorage areas for large numbers of ocean-going vessels, fishing boats and pleasure craft. Increased maintenance costs of these properties caused by pollution probably amount to an appreciable sum annually. Some bridge authorities have also expressed concern that the useful life of steel piers set in seriously polluted harbor and river waters may be shortened by reaction with hydrogen sulfide generated in bottom deposits.

Recreation losses attributable to damages to water resources from pollution are greatest in the more heavily populated northern half of the basin and in particular in the Boston metropolitan area where needs for water recreation are greatest. A good deal of Boston Harbor is unsuitable for recreational development because of the extensive areas set aside for navigation purposes and structures. This limits salt water beach recreation to the shoreline outside the harbor to a considerable extent. This in turn denies day-use recreational bathing to many thousands of persons not having transportation to more distant beaches.

The limited ocean beach facilities available to the residents of Metropolitan Boston make the inland water resources in the immediate vicinity all the more valuable and desirable for recreational development. The Charles, Neponset and Mystic River watersheds drain most of this area and contain almost all of the sites possible for freshwater recreation. At one time a good deal of these water resources were extensively used for all types of recreation. Pollution has gradually eliminated recreational use of these waters, particularly for bathing. At one time the Charles River Basin furnished recreational bathing for thousands of persons. As pollution encroached upon the Basin, recreational bathing became limited and at times of high temperature and low run-off, when bathing opportunities are most needed, the beaches were closed because excessive amounts of pollution endangered the public health. All of these beaches along the Charles River Basin now remain closed because of pollution and recreational bathing facilities for thousands of persons have been eliminated.

The only natural fresh-water bathing facilities remaining in the Boston area are on the Mystic Lakes in the Mystic River watershed. There are areas in the other watersheds where swimming is indulged in by various persons but it is in places where the bacterial quality of waters is unsuitable for this purpose and not approved by the State Department of Public Health. These sewage-polluted waters exist as a menace to the public health. There is, therefore, a substantial loss to the individual incurred in the elimination of water recreation opportunities, particularly bathing, through damages to the fresh water resources in the Boston area. The loss is to the health, welfare and enjoyment of thousands of the general public.

The ocean beaches are subject to pollution that results in minor damage to these water resources. The bacterial pollution is in no case of sufficient severity to warrant closing of any of these beaches to bathing under bacterial standards adopted by the State health department. There is damage at most of the beaches north of Nantasket Beach from an aesthetic standpoint which undoubtedly eliminates the use of these facilities by the more fastidious persons. The ocean beaches at Marblehead, Salem, Beverly, Danvers, Manchester, Nahant, Revere, Boston and Quincy are subject to pollution from objectionable materials of sewage origin from offshore ocean outfall sewers. These materials are in the form of grease balls, spent oils and other floating sewage debris. This form of pollution causes aesthetic nuisances that lower patronage by large numbers of persons unwilling to swim in sewage-polluted waters even though the contamination by sewage bacteria is well below the State health department's standards for safe bathing waters. Thus are eliminated bathing opportunities for additional thousands of persons.

To be added to losses discussed in preceding paragraphs are other losses incurred by the elimination or deterioration of recreational bathing waters. There are many commercial establishments, such as restaurants, ice cream and cold drink concessions and amusement parks, that are largely dependent on the patrons of nearby public and private beaches. When bathing patronage is lowered because of pollution of the waters or contamination of beaches these commercial establishments suffer a real economic loss. Such establishments are a part of the important recreation industry. If patronage falls by 25-50 percent of the normal because of pollution or contamination at beaches, it seems reasonable to assume that the receipts of dependent business places fall proportionately. The gross income of the commercial establishments serving the recreational areas along the coast of Massachusetts runs into the millions of dollars annually.

When recreational bathing areas are closed because of pollution, these water resources must be recovered or replaced, or the individual must travel further to more distant bathing waters, or the individual must forego the pleasures and benefits of recreational bathing. Any of these alternatives constitutes an additional cost to the individual for bathing privileges that is rightly charged to water pollution. Here again it is not possible to compute these costs. An indication is given, however, in the cost to date of replacing the bathing facilities lost through pollution of the Charles River Basin. To provide bathing opportunities for the thousands of persons who once frequented the Charles River beaches, the Metropolitan District Commission has constructed, or has under construction, four artificial swimming pools along the banks of the river. The appropriations for these swimming pools amounted to $1,310,000 and their cost, together with the annual operating and maintenance expenses, should be appropriately charged to damages from the pollution of the Charles River. More such pools are needed and planned for other areas in the metropolitan area where such recreation cannot be developed on the existing polluted waterways.

The added cost of travel to more distant recreational bathing areas necessitated by pollution of local water resources should be charged against water pollution. Thousands of people annually must travel to the beaches along the North Shore, the South Shore, Cape Cod and Buzzards Bay or to the freshwater ponds in the southern portion of the basin. The cost of these auto trips and bus fares amounts to a very considerable amount each year over the expense that would be involved if suitable bathing facilities were available in or near the metropolitan area.

The clam industry has suffered a considerable loss in income from pollution of the producing flats. Unfortunately, there are little data available on the number of acres of clam flats that are condemned against the taking of shellfish and from which the income is lost to the industry. The condemned areas are known to extend over several hundred acres, however, and include all but 18 small areas in Boston Harbor, almost all of Beverly Harbor and large areas in 18 other small harbors. Not all of these areas are producing clam flats but probably at least one-third of these areas would normally produce average clam yields. The average value of clams harvested per acre in 1950 was about $500. It can readily be seen that pollution of clam flats is causing a considerable loss in income each year and that the number of persons employed in this industry has been decreased. In addition, residents of many cities and towns are unable to dig clams for consumption at home. If pollution abatement would result in the re-opening of these condemned clam flats, the income and employment of this industry might be increased by as much as 25-50 percent.

In addition to the loss of income from condemned flats, the clam industry and the consumer pay an additional cost for damages from pollution. In moderately contaminated areas the State Department of Public Health permits master diggers to harvest clams for purification in the municipally-operated shellfish purification plant at Newburyport. Last year the purification plant processed over 25,000 barrels of clams for which the total cost was $31,430. This cost is chargeable to damages to clam flats from pollution that is actually being paid by the consumer.

In the absence of sufficient information on all the ramifications of costs of lawsuits, depreciated property values, capital expenditures for equipment, repairs, maintenance, loss of product, etc., caused by damages to the water resources from pollution, it is not possible to determine a reasonable dollar value for losses incurred. Neither are there available reliable cost-benefit indexes by which the less tangible damages to water resources, such as loss of opportunities for recreational bathing and game fishing, may be assessed. When reliable data and formulae are available it is estimated that the bill against damages to water resources in the Massachusetts Coastal Streams Basin will run into the millions of dollars annually.

There are still other losses caused by damages to water resources from pollution and which deserve serious consideration. Security, well-being, and pride are states of existence that cannot be measured by material standards. Intangible as these values to human existence may appear to be, the majority of citizens strive for their attainment on a personal, community and national level and on which much effort and large sums of monies are expended. Water is one of our most important natural resources, available to us in a relatively fixed quantity. Few realists would deny that damages to our water resources from pollution result in a real loss to individual, community and national security, spirit of well-being and sense of pride. Such losses cannot be expressed in terms of dollars and cents but efforts to avoid their loss are surely very much worthwhile.

BENEFITS RESULTING FROM POLLUTION PREVENTION AND ABATEMENT

General

Benefits that have accrued from past pollution prevention and abatement measures in the Massachusetts Coastal Streams Basin have been considerable. If there had not been planning and other measures taken to control pollution, damages to the water resources would be far greater than those that exist at the present time. However, although a considerable number of pollution prevention and abatement measures are in effect, there are existing sources of pollution that nullify many of the benefits that would normally be derived.

The prevention and abatement of pollution in the past has been largely carried out through the insistence and guidance of the Massachusetts Department of Public Health. The Metropolitan District Commission, which is a State agency created to serve the Boston metropolitan area, has coordinate authority with the State health department to control pollution of the Charles River within the Metropolitan Parks District. The Division of Marine Fisheries of the State Department of Conservation has the authority to issue an order to prevent discharge of wastes to coastal waters that affect valuable fisheries. These three agencies are responsible for the control and abatement of water pollution in the basin and planning of benefits in the best interests of the majority of the general public.

These State agencies have pollution prevention and abatement programs in progress. Rising taxes and construction costs are materially increasing the problems of the water pollution control authorities in effecting sound programs of pollution control. Municipalities, industries and individuals are becoming increasingly reluctant to finance the costs of needed treatment measures. It is unfortunate that many of these municipalities and manufacturing plants did not provide the required treatment or disposal of wastes years ago when such action was requested. Had this been done, most of the capital costs would have been paid before now and the basin would have long benefited from the conserved water resources.

The Massachusetts coastal region will gain much from the planning and execution of a comprehensive program for water pollution control. There has been a positive growth in population and number of industries in this area. As this growth continues, and this is expected, the demands on the already limited water resources will be even greater than at present. Programs that will conserve the present usable water resources and reclaim the damaged water resources, some even to a limited extent, will result in benefits to public health, recreation, economy and aesthetic values as well as many intangible gains.

Benefits from Present Pollution Control Measures in Effect

The setting aside of certain watershed areas throughout the basin, and protecting these from pollution, has allowed the development of 25 approved public surface water supplies that serve safe water to 724,960 persons residing within the basin in 34 communities and one institution. This water pollution control measure has long been in effect and has benefited the residents as an important phase of a program of protection to the public health. It could also be shown that protection of the watersheds has, in some cases at least, eliminated the need for expensive water purification facilities and in many cases simple chlorination suffices.

Many local health hazards and nuisance conditions have been eliminated or alleviated by the removal of private sewer outlets discharging into streams or coastal waters. Sanitary inspections and sampling programs of all public bathing areas are pollution control measures carried out by the State Department of Public Health in cooperation with local health officers.

Further benefits to the public health and elimination of local nuisances were gained by communities and schools located on small streams by providing adequate sewage treatment. Construction of some of the larger municipal sewage treatment plans has eliminated gross pollution and in a few instances, after some self-purification, the water becomes satisfactory for most uses. Four communities have provided sewage treatment works from which limited benefit accrues because existing facilities are inadequate. Eight municipalities have unsatisfactory ocean outfall sewers. There are also three institutional sewage treatment plants that require chlorination of effluents to safeguard downstream water qualities.

Wherever possible, in this highly urbanized region, the State Department of Public Health has recommended that connection to municipal sewers, with pre-treatment when necessary, be the method of disposal for industrial wastes. This has been done for a large number of industrial establishments that formerly discharged process wastes directly to watercourses. The elimination of this large number of sources of pollution has been of real significance in the prevention of gross pollution of watercourses and local nuisance conditions.

Benefits from the construction and operation of industrial waste treatment plants have been reasonably significant even though of the 27 facilities that have been placed in operation only 11 are known to discharge satisfactory effluents to streams or ground water. While a high proportion of the existing treatment works are producing unsatisfactory reductions of polluting materials, their operation has considerably raised the water quality in receiving streams. Treatment provided, however, is not adequate to result in downstream water qualities needed for future intended uses.

Extra profits from the operation of treatment facilities have been realized by three companies. One wool scouring plant recovers wool grease for marketing, one detergent manufacturing plant recovers valuable fatty acids for re-use in processes and one paper mill recovers worthwhile amounts of fiber. Some of the other manufacturing plants having treatment plants could also probably recover valuable by-products if units were operated for this purpose.

The manufacturing establishments operating satisfactory industrial process waste treatment plants and those which have provided adequate pre-treatment and disposal of process wastes to municipal sewers have realized a real benefit from these pollution abatement measures in improved public relations. A manufacturer who accepts his community obligations is a good neighbor, a desirable member in a progressive community.

While the benefits from the operation of adequate sewage and industrial waste treatment facilities have been somewhat obscured by other sources of untreated or unsatisfactorily treated pollution, these operations do represent a significant benefit in pointing the way towards completion of a comprehensive pollution control program. In many cases existing plants, and those under construction, serve to show that treatment can be accomplished without undue financial hardship and from which significant benefits can be achieved.

Benefits Achievable from a Comprehensive Pollution Control Program

There are a significant number of desirable and worthwhile benefits to be gained from the planning and execution of a comprehensive pollution prevention and abatement program in the Massachusetts Coastal Streams Basin. In addition to the immediate benefits that would be of practical value and use to a variety of interests, there would be additional benefits projected into the future through the reclamation and conservation of the water resources for their fullest practicable use. It is not usually predictable when the availability of suitable water resources will be important to the future welfare and economy of a region. On the other hand it can be predicted with reasonable accuracy that opportunities for development and expansion will not be open to those communities unprepared to offer this vital natural resource.

It is generally agreed that the undamaged water resources available for use and development in this basin are limited in number and there is real need to develop all of the water resources for the best use of the majority of interests.

From the information and data at hand it appears that there are at least 12 significant and worthwhile benefits to be achieved through a comprehensive water pollution prevention and abatement program in the Massachusetts Coastal Streams Basin and these follow:

1. There will be a benefit to the public health by the adequate treatment and/or elimination of sources of domestic and industrial sewage pollution by reducing the chances for waterborne disease infection. Sewage-polluted waters are always a menace to the public health however remote this possibility may appear to be.

2. Long stretches of presently polluted streams, representing the principal fresh waters of the basin, will be made suitable for development by the important private recreational industry which would, in turn, result in increased employment, income and economic stability.

3. The abatement of pollution of the principal streams of the basin would allow the development of public recreational facilities by State and local governments. Residents could not only benefit from greater opportunities for bathing, boating, fishing, hunting and picnicking, but could realize substantial savings in travel costs as well by having these facilities in the community or nearby.

4. Elimination of nuisance conditions and health hazards at ocean beaches, caused by floating materials of sewage origin, would contribute substantially to the improvement of the aesthetic quality of the bathing waters and beaches. This would materially increase beach patronage by persons now offended by the nuisances sometimes created and offer greater opportunities for all to enjoy recreational bathing benefits. Increased beach patronage would have a further benefit in stimulating income and employment at business places dependent on beach attendance.

5. Industries now located in the basin could realize a savings through reduction of present water treatment costs to produce a usable process water and some may find it unnecessary to treat process waters at all. In some localities, industries purchasing water from municipalities may find the improved stream waters to be of suitable quality for process purposes. The substitution of available stream waters for purchased municipal supplies by industries would represent a savings in production costs.

6. Large volumes of readily accessible waters at the more desirable industrial locations could be made suitable for the attraction of new industry that could result in increased employment, income and economic stability.

7. Some of the manufacturing plants now producing industrial wastes could realize a significant savings in production costs or waste treatment costs through recovery of valuable by-products and greater utilization of raw materials.

8. Industrial, residential and recreational real estate located on, or dependent on, presently polluted watercourses would be made more attractive and desirable and considerably increased in value by the abatement of pollution.

9. The abatement of pollution of the coastal waters would improve the quality of water now covering condemned clam flats and permit the re-opening of many acres. This could result in increased income and employment in the important shellfish industry.

10. Aesthetic nuisances created by gross pollution during periods of critical low flows, conditions offensive to both residents and visitors, would be eliminated by pollution abatement.

11. Industries contributing to damages to water resources would experience a worthwhile benefit from improved public relations through abatement of pollution for which they are responsible.

12. Not the least of the benefits to be gained from a sound program of pollution prevention and abatement, and possibly the most important, are the stimuli to the general welfare and well-being of the basin and its citizens. These benefits will be experienced in the security gained from the knowledge that important resources have been conserved, in the pleasures derived from the restoration of the natural beauty of the streams and in the enhanced reputation of the area in the eyes of visitors. Further there would be greater opportunities for all to enjoy and profit by the use of the water resources and a satisfaction to the public spirit gained through the completion of a community obligation to safeguard the water resources for which it is responsible.

The extent to which these possible benefits will be realized from a comprehensive pollution prevention and abatement program in the Massachusetts Coastal Streams Basin will depend to a very large degree on the understanding, cooperation and efforts of the citizens and industries. Without these essential components the abatement program cannot be comprehensive. Those who must contribute to a successful program of pollution abatement are, in the final analysis, the ones who will be most benefited.

Section 12

POLLUTION PREVENTION MEASURES IN EFFECT

General

The Massachusetts Coastal Streams Basin, as its name implies, is comprised of the watersheds of the streams draining the coastal area of Massachusetts. Most of the population of the basin is concentrated in cities and towns along the coast. With a huge volume of tidal water available for dilution, the method of choice for disposal of municipal sewage has been by discharge into the coastal waters through ocean outfall sewers in most cases. The sewage from approximately 98 percent of the sewered population is disposed of by dilution in the ocean and this is probably near the correct figure for industrial wastes as well.

Fourteen communities have constructed sewage treatment plants for the disposal of municipal sewage. In all cases save one, secondary sewage treatment has been provided before effluents are discharged to watercourses or, as in two instances, to subsurface disposal fields. Two communities do not operate sewage treatment plants but have completed municipal sewage treatment projects that required disposal of domestic wastes by the responsible individual. Sixteen other communities, mostly small, have no sewage treatment facilities and discharge municipal sewage directly to watercourses without treatment. There are also seven municipalities that have ocean outfalls but portions of each community not served by municipal sewers discharge sewage to streams or coastal waters without treatment.

Each of the 19 institutions in the basin, and this does not include institutions in the larger cities served by municipal facilities, has been provided with a secondary sewage treatment plant. The treated effluents are discharged to streams with two exceptions that are discharged to subsurface drainage.

Included above are two institutions and two municipalities discharging treatment plant effluents to subsurface disposal fields, causing no stream pollution and not previously counted as such.

Of the total of 35 separate sources of industrial waste pollution discharged to streams, 23 manufacturing plants have provided treatment facilities. Unfortunately, most of these facilities are not satisfactory because treatment works are inadequate in design or capacity, or both, to produce the desired reduction of pollution. Most of the wastes are organic and of a type generally producing a considerable pollutional load.

The problems of pollution in this highly urbanized basin have been the subject of study for many years. Comprehensive surveys of sources of pollution and their effects on receiving waters have been made where the largest problems have existed. Research on the treatment of industrial wastes has been, and is being, carried out at the Lawrence Experiment Station of the State Department of Public Health. The files of the Department on water pollution in the basin are rather complete and contain sufficient information to proceed in the formulation of a comprehensive program of water pollution prevention and abatement. It may be necessary, however, to conduct additional surveys and investigations to accumulate supporting data and to assist in the solution of the more difficult industrial waste treatment problems.

The results of past pollution prevention measures taken in the basin have been the construction of 14 municipal sewage treatment plants, 19 institutional sewage treatment plants, 23 industrial waste treatment plants, and 13 ocean outfall sewers. In addition, a large number of sources of pollution from private sewers have been eliminated or adequately treated, and many sources of industrial waste pollution, once discharged directly to watercourses without treatment, have been eliminated by connection to municipal sewers. Unfortunately, many of the treatment measures have not resulted in a satisfactory solution of the problems involved and additional measures are required.

The State Department of Health is handicapped in the development of a comprehensive program of pollution prevention and abatement by a number of factors. The Department did not have an adequate water pollution control law until 1945 and this was subsequently shown to require some amendment. This agency does not have sufficient personnel and funds to carry out needed surveys, investigations and research necessary in a comprehensive program of pollution abatement. The rising costs of living and doing business are increasing the reluctance of citizens and industry towards providing funds for needed treatment works. The State Department of Public Health does not have funds for programs of education of the public and industry in the needs for and benefits from pollution prevention and abatement. Neither does the Department have funds and personnel to promote community planning projects to insure that pollution control programs would result in the conservation and utilization of the water resources in the best interests of the majority served.

Status of Municipal Sewage Treatment Plants in Operation

There are 29 communities served by 14 sewage treatment works. A total of 669,740 persons are served and all of the sewage treatment plants provide secondary treatment, except the Nut Island primary treatment plant serving the South Metropolitan Sewerage District. All of the municipal sewage treatment plants are satisfactory in operation and capacity except four.

The towns of Provincetown and Wilmington do not have municipal sewerage systems. However, 1,000 persons in Provincetown have adequately disposed of domestic sewage by treatment in cesspools and subsurface leaching fields. The domestic sewage from 300 persons in Wilmington is unsatisfactorily treated in cesspools which overflow into the Ipswich River.

Table 10, which follows, lists the data on existing municipal sewage treatment plants in operation.

Table 10--Census of Municipal Sewage Treatment Plants, Massachusetts Coastal Streams Basin, 1952

Community 1/	Population Served	Treatment		Effluent	
		Type 2/	Status 3/	P.E. 4/	Discharged to
Abington (T)	750	S	I	375	French Stream
Barnstable (T)	250	S	A	25	Atlantic Ocean
--Hyannis (V)	3,000	S	A	0	Ground Water
Bourne (T)					
--Sagamore Apts.	125	S	I	50	Cape Cod Canal
Falmouth (T)					
--Housing Project	225	S	A	25	Morse Pond
Franklin (T)	3,900	S	I	750	Mine Brook
Ipswich (T)					
--Veterans Housing	200	S	A	10	Ipswich River
--Old Vet. Housing	100	S	I	25	Ipswich River
Marion (T)	1,000	S	A	100	Buzzards Bay
Medfield (T)	500	S	A	50	Charles River
Milford (T)	9,000	S	A	390	Charles River
Millis (T)	200	S	A	Negligible	Charles River
Nantucket (T)	9,600 (Summer)	S	A	0	Ground Water
South Metropolitan Sewerage District 5/	640,890	P	A	516,000	Quincy Bay
Totals	669,740			517,800	

1/ T - Town; V - Village
2/ S - Secondary; P - Primary
3/ A - Adequate; I - Inadequate
4/ P.E. - Pollution in equivalent number of persons.
5/ Serves 15 cities and towns and part of Boston; also listed under municipal ocean outfall sewers.

Status of Municipal Sewage Disposal at Ocean Outfalls

The municipal sewage from 48 cities and towns, having a combined population of nearly 2,150,300 persons, is discharged into the coastal waters of the basin at 13 ocean outfall sewers. This method of sewage disposal serves about 98 percent of the total sewered population and probably a proportionate volume of the industrial wastes produced. The South Essex Sewerage District system serves four municipalities, the North Metropolitan Sewerage District serves 17 communities and a part of Boston, the South Metropolitan Sewerage District serves 15 cities and towns and part of Boston, the Boston Main Drainage System serves the remainder of the city not served by the Metropolitan Sewerage Districts, the city of New Bedford discharges the sewage from the neighboring town of Dartmouth through its ocean outfall sewer as does the city of Lynn for the town of Saugus.

The disposal of municipal sewage at five ocean outfall sewers serving 20 communities and part of Boston, having a total population of about 772,300, is satisfactory. Eight ocean outfall sewers serving the remaining 1,378,000 persons residing in 27 cities and towns and part of Boston do not provide adequate disposal and projects to control pollution of coastal waters are required. The greatest amounts of pollution by far are discharged into Boston Harbor by the North Metropolitan Sewerage District and the Boston Main Drainage System. The two outfall sewers are so located, and the amount of pre-treatment given so inadequate, as to be unsatisfactory for the disposal of sewage from a total of nearly 1,166,000 persons and the industrial wastes from a large number of manufacturing plants.

Table 11, below, lists the cities and towns served by ocean outfall sewers and shows the adequacy of disposal by this method.

Table 11--Census of Municipal Ocean Outfall Sewers,
Massachusetts Coastal Streams Basin, 1952

Community or Sewerage System	Population Served	Pre-treatment	Adequacy of Disposal
Boston Main Drainage System	45[illegible] 000		Unsatisfactory
Falmouth town --Woods Hole	150		Satisfactory
Gloucester city	18,000		Satisfactory
Lynn city (Outfall sewer also used by Saugus town)	102,550	Screens	Satisfactory
Manchester town	1,800		Unsatisfactory

Table 11--Census of Municipal Ocean Outfall Sewers,
Massachusetts Coastal Streams Basin, 1952(Cont.)

Community or Sewerage System	Population Served	Pre-treatment	Adequacy of Disposal
Marblehead town	10,800		Unsatisfactory
Nahant town 1/	2,000		Unsatisfactory
New Bedford city	110,000	Bar racks	Unsatisfactory
(Also serves Dartmouth town)			
North Metropolitan District System	712,980		Unsatisfactory
(Serves Arlington, Belmont, Cambridge, Chelsea, Everett, Lexington, Malden, Medford, Melrose, Reading, Revere, Somerville, Stoneham, Wakefield, Winthrop, Winchester, Woburn and part of Boston)			
Rockport town	2,000		Unsatisfactory
South Essex Sewerage District	84,400	Grease removal, screens, grit chamber	Unsatisfactory
(Serves Salem, Peabody, Beverly and Danvers)			
South Metropolitan District System	640,890	Primary; Chlorination	Satisfactory
(Serves Braintree, Brookline, Canton, Dedham, Milton, Needham, Newton, Norwood, Quincy, Stoughton, Walpole, Waltham, Watertown, Wellesley, Weymouth and part of Boston)			
Swampscott town	10,700	Comminutor	Satisfactory
Total	2,150,270		

1/ Has several sewer outlets to ocean--counted as one source of pollution.

Status of Institutional Sewage Treatment Plants in Operation

Outside of institutions in urban communities served by municipal facilities, there are 19 population centers in the basin classified as institutional. Included in this category are two colleges, five schools and three military establishments.

All of the institutions have been provided with secondary sewage treatment facilities to serve a total of more than 10,000 persons. The population figures for military bases are not given. All of the sewage treatment plants are satisfactory in design and operation although three require the addition of chlorination of effluent to safeguard water qualities for downstream users. Camp Edwards and St. Coletta School discharge effluents through subsurface disposal systems and are not counted elsewhere in this report as sources of pollution.

Table 12 is a census of institutional sewage treatment.

Table 12--Census of Institutional* Sewage Treatment Plants, Massachusetts Coastal Streams, 1952

Institution and Location	Population Served 1/	Effluents 2/		
		Status 3/	P.E. 4/	Discharged to
Braintree town --Norfolk Co. Hospital	145	S	Neg.	Cochato River
Falmouth town --Camp Edwards	N	S	0	Subsurface
Foxboro town --State Hospital	1,500	S 5/	26	Neponset River
Hanover town --St. Coletta School	85	S	Neg.	Herring Brook
Hanson town --Plymouth Co. Hospital	155	S	Neg.	Indian Head Brk.
Medfield town --State Hospital	2,300	S	55	Charles River
Norfolk town				
--Pondville Sanitarium	245	6/	Neg.	Stop River
--Prison Colony	900	6/	Neg.	Stop River
North Reading town --State Sanitorium	165	S 5/	Neg.	Martin's Brook
Randolph town --Boston School for the Deaf	200	S	0	Subsurface
Rockland town				
--Jefferson School	230	S	23	Unnamed Brook
--High School	500	S	10	to French Stream

Table 12--Census of Institutional* Sewage Treatment Plants, Massachusetts Coastal Streams, 1952 (Cont.)

Institution and Location	Population Served 1/	Effluents 2/		
		Status 3/	P.E. 4/	Discharged to
Wellfleet town				
--Camp Wellfleet	N	S	N	Atlantic Ocean
Weston town				
--Regis College	475	S	24	Unnamed Brook
--Weston College	270	S	Neg.	Cherry Brook
Weymouth town				
--Naval Air Station	N	S 5/	N	French Stream
--South Shore Hospital	150	S	N	Mill River
--Homestead School	300	S	30	Cochato River
Wrentham town				
--State School	1,940	6/	Neg.	Stop River
Total	9,960			

* Includes significant public and private institutions, schools and military reservations outside of urban areas.

1/ N - Data unavailable.
2/ All effluents from secondary sewage treatment plants.
3/ S - Satisfactory; U - Unsatisfactory
4/ P.E. - Pollution in equivalent number of persons; Neg. - Negligible.
5/ Treatment includes chlorination.
6/ Treatment plant adequate in capacity but location requires chlorination of effluent.

Status of Industries Having Treatment Facilities in Operation

There are 44 industrial establishments known to discharge process wastes directly to watercourses and some also discharge sanitary wastes from employees. Twenty-three of these sources of industrial waste pollution have been provided with treatment facilities and 21 are discharged directly to streams without treatment. Four other manufacturing plants have treatment facilities with effluents discharged to ground water and are not elsewhere listed in this report as sources of pollution.

Eleven of this total of 28 industrial waste treatment plants are rated as satisfactory in design and operation and 17 are rated as being inadequate in these respects. The total pollution load discharged from unsatisfactory industrial waste treatment works is equivalent to the domestic wastes from more than 41,000 persons. Satisfactory industrial waste effluents have a total population equivalent of nearly 14,000 persons.

Two manufacturing plants produce no process wastes but discharge employee sewage to watercourses. One plant provides inadequate treatment of sewage before disposal and the other discharges this waste untreated. All of the industrial plants providing process wastes have treatment or disposal facilities for employee sewage, usually satisfactory.

Table 13 lists the data on industrial waste treatment.

Table 13--Census of Industrial Waste Treatment Facilities, Massachusetts Coastal Streams Basin, 1952

Plant Location and Type of Wastes Produced	Treatment		Effluent	
	Type	Status 1/	P.E. 2/	Discharged to
Middletown town --Leather finish chemicals	Sedimentation; Sand filters; Chlorination	S	31	Ipswich R.
Ipswich town --Slaughterhouse	Cesspools	S	0	Subsurface
Wilmington town (N. Wilmington village) --Tannery	Sedimentation; Sand filters; Chlorination	U	1,250	Lubber Brk.
Peabody city --Chemical mfg.	Sedimentation	U	125	North River
Danvers town --Tannery	Sedimentation	S	Neg.	Danvers R.
Everett city				
--Coke & by-products	Coke filter	U	DNA	Mystic R.
--Artificial gas	Coke filter	U	DNA	Mystic R.
--Tar refining	Coke filter	U	DNA	Mystic R.
--Oil refining	Skimming tanks	U	DNA	Mystic R.
Malden city --Artificial gas	Coke filter	U	DNA	Malden R.
Bellingham town				
--Wool dye & finish	Lagoon	U	5,550	Charles R.
--Wool scouring	Sedimentation; Chemical	S	3,100	Charles R.

Table 13--Census of Industrial Waste Treatment Facilities, Massachusetts Coastal Streams Basin, 1952(Cont.)

Plant Location and Types of Wastes Produced	Treatment		Effluent	
	Type	Status 1/	P.E. 2/	Discharged to
Walpole town				
--Paper (white water)	Sedimentation	U	22,000	Neponset R.
--Paper (white water)	Sedimentation	U	12,000	Neponset R.
Hyde Park (Boston city)				
--Paper (white water)	Save-all	S	140	Neponset R.
Canton town				
--Slaughterhouse (fowl)	Cesspools	U	100	E. Branch
--Rubber processing	Sedimentation	U	DNA	E. Branch
Quincy city				
--Detergent mfg.	Flocculation; Flotation	S	10,700	Quincy Bay
Weymouth town				
--Commercial laundry	Sand filters	U	40	Mill River
--Dairy	Cesspools	U	100	Weymouth Fore River
Scituate town				
--Commercial laundry	Sand filters	S	Neg.	Satuit Brk.
Abington town				
--Ice cream mfg.	Septic tank	U	280	French Stream
Wareham town				
--Cranberry products	Screens; cesspool; dry well	S	0	Subsurface
Fairhaven town				
--Tack mfg. (plating)	Lagoon	U	DNA	Buzzards Bay
Falmouth town				
--Commercial laundry	Sedimentation; dry wells	S	0	Subsurface
Yarmouth town (W. Yarmouth village) --Commercial laundry	Sedimentation; trickling and sand filters	S	0	Subsurface
Chatham town				
--Commercial laundry	Sedimentation; sand filters	U	N	Stepping Stone Brk.
Total			55,416	

1/ S - Satisfactory treatment; U - Unsatisfactory treatment.
2/ DNA - Does not apply; wastes not computable in terms of population equivalent; Neg. - Negligible; N - Undetermined.

Policy of the State Department of Public Health

The Massachusetts State Department of Public Health administers pollution abatement programs as individual projects wherein river basins or sub-basins are taken as the smallest investigational and survey unit. Surveys are made to locate and measure sources of pollution and investigations made to determine the most suitable methods of disposal. Funds for surveys and investigations are appropriated by the passage of legislative resolves by the General Court to which reports of findings and recommendations for procedure to abate pollution are made. On completion of the necessary studies and rendering of the report, orders may be issued by the State Department of Public Health to abate pollution and the manner in which it is to be accomplished is prescribed. The services of consulting engineering firms are sometimes retained to assist in special projects.

The Department has long operated on the policy that the highest priority be given to the abatement of nuisances created by water pollution and to petitions for abatement of conditions of water pollution. The program policy requires that no untreated sanitary sewage or significant amounts of industrial wastes will be permitted to discharge to watercourses without treatment.

The Massachusetts State Department of Public Health has established a policy whereby the planned pollution abatement programs will, wherever possible, result in a water quality not less than the "C" classification standard tentatively adopted by the New England Interstate Water Pollution Control Commission. This classification requires that the quality of water be maintained in a condition suitable for recreational boating, irrigation of crops not consumed without cooking, and habitat for wildlife and common food and game fish indigenous to the region. The chemical standards of this water quality will require the maintenance of a minimum concentration of dissolved oxygen of five parts per million; the absence of odor, scum, floating solids, sludge deposits, and phenols or other taste-producing substances; unobjectionable amounts of oil, grease, color, and turbidity; and non-toxic concentrations or combinations of potentially toxic substances. No bacterial standards for this quality of water have been adopted.

State Laws in Effect

The State of Massachusetts has vested most of the statutory powers and duties relating to water pollution in the Department of Public Health. In addition, the Metropolitan District Commission has authority to make rules and regulations preventing the pollution of the Charles River within the Metropolitan Parks District (Chapter 92, Section 39 of the Massachusetts General Laws), to order the removal of polluting materials from the Charles River and its tributaries below Waltham from the Charles River Basin (Chapter 92, Section 76, Massachusetts General Laws), and to regulate the taking of water from the Charles River Basin. Further, the Division of Marine Fisheries of the Department of Conservation also has authority to prevent pollution of coastal waters injurious to marine fisheries (Chapter 130, Sections 22 and 23, Massachusetts General Laws).

The regulations promulgated by the Department of Public Health under the statutory authority to make rules and regulations to prevent pollution of all lakes, ponds, streams, idle waters and flats are considered by the Department of Public Health to be geographically comprehensive and adequate to enforce needed pollution control measures.

The legislation in Massachusetts concerning the control of the pollution of waters appears to have been enacted piecemeal. Some of the legislation is general; some is particular; some is contained in public laws; and some is contained in special law. It is therefore difficult to determine whether particular questions arising under these laws will be determined judicially under one statute or another.

A synopsis of Chapters 92,111,120 and 615 of the Massachusetts General Laws, which regulate pollution of the water resources in the Massachusetts Coastal Streams Basin, is submitted in Appendix "F".

Status of Water Pollution Control Program in Basin

All public surface water supplies are required to be taken from approved sources and are subject to periodic sanitary inspections and analyses by the Department of Public Health. All new sources of public water supply are required to be approved by the Department and are subject to the same controls for sanitary quality. Public bathing waters are routinely inspected and sampled and their use is approved or disapproved by the State health department.

For some years during the months of June through November, the Division of Sanitary Engineering has carried out a sampling program of the principal streams transporting pollution. The laboratory records of the analysis of these catch samples are on file and are used to classify present stream conditions and to determine, in part, the degree of treatment that will be necessary in a comprehensive pollution abatement program.

In addition to the general information on sources and types of pollution on file, the Department has made a number of special investigations of pollution of bathing beaches and certain of the streams in the basin. Reports of these investigations have been made to the General Court. The data compiled during these special investigations form the basis of recommendations to control pollution on which the Department has taken and proposes to take action. Many of these investigations have been completed within the past five years. Included in these special reports are investigations of causes creating nuisances on the shores and beaches of Swampscott, Marblehead, Salem, Danvers, Beverly and Manchester.

The problem of satisfactory disposal of municipal sewage from the Boston Main Drainage System, the North Metropolitan Sewerage District and the South Metropolitan Sewerage District has occupied the authorities for years. In 1899 the State Board of Health, under the provisions of Chapter 65 of the Acts of 1899, made a complete report on the then existing pollution of Boston Harbor. In subsequent years a number of such reports were made to the General Court by the Joint Board composed of the State Board of Health, the Director of the Port of Boston, and the Commissioner of Public Works of Boston, and by special commissions relative to the pollution of Boston Harbor and of tributary streams. Some of these special investigations were joined in by the Metropolitan District Commission to consider improvement and extensions to its sewerage systems but all investigations had overtones of pollution control for Boston Harbor and streams discharging into the harbor.

These investigations have resulted in action to provide the necessary sewerage improvements and sewage treatment works to give the greatest relief from pollution of Boston Harbor and tributary streams under present existing conditions. In 1945 the General Court enacted Chapter 705 of the General Laws of Massachusetts which authorized the expenditure of $15,000,000 for extensions and improvements to the South Metropolitan Sewerage District system and for the construction of the Nut Island sewage treatment works to serve this system. In 1949 the General Court, through Chapter 606 of the General Laws of that year, authorized the sum of $25,000,000 for improvements to the North Metropolitan Sewerage District and construction of treatment works at Deer Island. In 1951 the General Court again took action and Chapter 645 authorized enlargements of the Deer Island plant and improvements to the sewerage systems of the District to treat the remaining sewage from the City of Boston not already intercepted by the District.

The final plan for pollution control of Boston Harbor and certain of the tributary streams has not yet been agreed upon between the Metropolitan District and the City of Boston, but the general plan will require the construction of tunnels, shafts, headworks and pumping stations for intercepting and conveying the sewage to Deer Island for treatment in a primary sewage treatment plant. Construction of certain of these works is already underway and the project is scheduled for completion in 1958.

The joint field survey by the Massachusetts Department of Public Health and the Public Health Service extended over a period of ten weeks and included investigations of sources of pollution. During its progress it is believed that all significant sources of sewage and industrial waste pollution were located. Where required for solution of the problems involved, sources of pollution were measured.

The general information accumulated through the years and the results of other special investigations authorized by the General Court have furnished the Department of Public Health with sufficient data to proceed with a comprehensive plan for pollution abatement in the basin. All of the principal sources of pollution are known and the type of project required to abate pollution for each has been determined in general. Although there are some handicaps to be overcome and some studies on special problems which need to be made, the Department of Public Health is forwarding a comprehensive pollution control program by requiring action where project requirements are known.

Attitudes Towards Pollution Prevention and Abatement

To accurately gage the attitudes of the public and industry towards pollution prevention and abatement is difficult inasmuch as few polls of opinion have been recorded. Judging from newspaper reports and results of public hearings on water pollution, the general public in this basin favors water pollution control.

The State Department of Public Health does not have a well-developed program for informing the public and industry in the needs for and benefits from pollution prevention and abatement. It does not have sufficient funds for these needed purposes. As a result there has been little community planning and the public remains more or less unorganized. Through the activities of the water pollution control agencies, other State agencies and private organizations, it is known that there is a growing demand by the public for pollution abatement, particularly by those interested in greater privileges in all types of water recreation. Were the public organized, understanding of the needs for pollution abatement and their desires made known, there is little doubt that unified, thoughtful support of a comprehensive program of pollution prevention and abatement would be forthcoming.

Section 13

POLLUTION PREVENTION MEASURES REQUIRED

General

The State of Massachusetts is committed as a member of the New England Interstate Pollution Control Commission to classify the waters of the Massachusetts Coastal Streams Basin as to the future intended uses.

Some real progress towards comprehensive pollution control has already been accomplished. With the exception of the Boston metropolitan area the general pollution abatement program required is known. Many sewage and industrial waste treatment works have been constructed. A large number of sources of pollution have been eliminated by requiring connections to existing municipal sewers.

There is yet a great deal to be done before comprehensive pollution prevention and abatement is in full effect. A large proportion of the existing industrial waste treatment plants are inadequate. There are 21 other manufacturing plants that discharge process wastes to watercourses without treatment. Thirty-four sources of municipal sewage pollution will require some kind of project to abate pollution. The effluents from three institutional sewage treatment plants require chlorination. There are surveys and investigations needed to accumulate data to support recommendations for pollution abatement measures to be required.

The largest problem of pollution in the basin by far, and this is the pollution of Boston Harbor, is being resolved by action recently taken by the General Court. While this report has been in preparation the Nut Island sewage treatment plant serving the South Metropolitan Sewerage District was placed in operation and the General Court has authorized enlargements in proposed construction of similar works at Deer Island to serve the remainder of the Metropolitan District and the Boston Main Drainage System.

The State Department of Public Health is well aware of the needs for a comprehensive pollution prevention and abatement program in the Massachusetts Coastal Streams Basin. The Department is also aware of a need for a positive, effective approach to the problems involved to insure an expedient and reasonable solution. To support the experienced recommendations of the Department there is a real need for cooperation between agencies concerned with pollution and all persons interested in the conservation and use of the water resources.

Personnel Requirements

The Massachusetts State Department of Public Health does not have a large enough technical staff to effectively administer a definitive water pollution control program. It is not enough to have the authority to order pollution abatement. Recommendations accompanying pollution abatement orders should be supported by adequate technical data to insure that the measure ordered is workable, reasonable and equitable and will solve the problem involved. Such data require engineering and laboratory investigations which in turn require personnel and funds that the Department does not now have available.

The present technical staff, and the funds available to it, are so limited as to require a long-term pollution abatement program. The most undesirable features of a long-term program are the delayed accruement of benefits which, when accomplished, are seldom apparent to those benefited and the difficulty of maintaining public support over a long period. There has yet been found no suitable substitute for concerted and cooperative action to accomplish a needed task.

Additions to the present technical staff of the State health department and funds to carry out needed investigations, surveys and research are a real requirement for a successful comprehensive water pollution control program in the Massachusetts Coastal Streams Basin.

Public Information and Community Planning

The Massachusetts Department of Public Health does not have funds for the dissemination of information for the education and guidance of the public and industry in the needs for and benefits to be gained from stream pollution abatement.

Funds for the enlightenment of the public and industry in the needs for pollution control and to promote cooperative community planning projects in the conservation and maximum use of the water resources should be considered essential to a successful comprehensive water pollution control program. A sound program of water pollution control, planned in the best interests of the majority, will usually be supported by the public and industry when they are well informed.

Financing Remedial Treatment Measures

Chapters 44 and 83 of the Massachusetts General Laws provide for the methods by which sewerage and sewage treatment works may be financed. Cities and towns may incur indebtedness for water and sewage works within limits of two and one-half and five percent respectively of their assessed valuations of taxable properties. Cities and towns may also finance such works outside the constitutional debt limits by special act of the legislature. This last is almost always the method of choice because financial institutions generally offer a more favorable interest rate on loans specifically authorized by the General Court.

The State Department of Public Health makes every effort to devise and recommend treatment measures that are reasonable and equitable. On the basis of past experience, combined with present-day information, the Department has arrived at a conclusion that the majority of municipalities and manufacturing establishments can provide the degree of treatment required by pollution abatement programs in progress without undue financial hardship.

Legislation

State laws regulating stream pollution in the Massachusetts Coastal Streams Basin are considered adequate by State authorities to enforce present needed pollution control. The Massachusetts General Court recently passed an Act making more clear the application of laws pertaining to governmental agencies for the protection of the public health through the prevention of pollution and contamination of waters.

Pollution Prevention and Abatement Programs in Progress

Definite progress towards pollution prevention and abatement in the Massachusetts Coastal Streams Basin has been achieved but much more needs to be done in the fields of sewage and industrial waste treatment and disposal if a comprehensive plan for the whole basin is to be accomplished.

Surveys have been made in the past and some of the data accumulated needs to be brought up to date. Other surveys need to be completed to fill gaps in the available information on sources of pollution and the remedial measures to be required. Although in most cases the locations of sources of pollution and the types of waste discharged are known, there is insufficient information on the volumes and strengths of wastes to be treated. These data are needed to insure that recommendations for pollution abatement measures will be reasonable and equitable and will accomplish the desired results.

If a comprehensive plan of pollution prevention and abatement is to be accomplished in the Massachusetts Coastal Streams Basin, surveys of stream water quality are needed. The effects of pollution discharged, the future intended stream uses, the allowable pollutional load, and the amount of pollution abatement required to result in the desired stream water qualities need to be determined for many watercourses. The State health department has adopted this procedure as sound engineering policy on which to base well-founded pollution abatement programs, provide data for pollution control measures, furnish accurate information for the public at hearings and town meetings, and to support court proceedings when necessary.

A number of industries in the basin produce process wastes for which adequate and reasonable methods of treatment have not as yet been completely developed. Studies to determine the best practicable methods for treating these industrial wastes, together with relative cost data, are needed. Studies are also needed to measure the feasibility of greater utilization of raw materials and recovery of by-products by industry. Such investigations would be most productive if made cooperatively by industry and the State health department which has its famous Lawrence Experiment Station available for such research.

The Massachusetts State Department of Public Health, through the functions of its Division of Sanitary Engineering, is progressing in its program to require treatment of all sources of sewage pollution needing projects. Of the total of 37 municipal and institutional sewage projects to be required, nine are now under construction, three have final plans for proposed works approved by the Department, five have preliminary plans approved, 10 are in the active planning stage, three have been requested by the Department to take action to provide recommended measures and ten projects are in an inactive status. In the active planning stage are the aqueducts and treatment works to serve the North Metropolitan Sewerage District and the Boston Main Drainage System with combined populations of 1,165,980.

The progress in industrial waste treatment projects to be required is not quite so advanced as sewage treatment projects. There are 35 industrial waste treatment projects known to be required and of these, two have final plans for treatment measures to be taken approved by the Department, 11 industries are actively planning treatment facilities and 22 industries have taken no action to provide recommended works. In addition, two manufacturing plants require projects for employee sewage of which one is actively planning facilities and one has taken no action.

Pollution Prevention and Abatement Projects Required

The proposed program for the abatement of municipal and institutional sewage pollution requires a total of 37 projects. Ten of these projects consist of constructions of new treatment plants to serve 26 municipalities; four projects are for installation of comminutors or screening devices preceding disposal of sewage at ocean outfall sewers; two municipalities will be required to construct satisfactory ocean outfall sewers with pre-treatment; one existing ocean outfall required addition of multiple outlets; four sources of municipal pollution will require extension of municipal sewers to intercept portions of the communities not now served by existing sewerage systems; seven projects require connection of sources of sewage pollution to the existing municipal sewerage systems, construction of new plants, or treatment at the individual outlets by the home owner, whichever plan is found most suitable in the locality concerned; two small communities will require adequate treatment of sewage at the individual sources of pollution; three existing plants require additions and one needs replacement; and three institutions require the installation of chlorinators to existing satisfactory treatment plants.

The total population to be served by the above projects is approximately 1,421,500 persons. One of the projects is to serve the North Metropolitan Sewerage District and the Boston Main Drainage System and this is the proposed Deer Island sewage treatment works. When completed, this sewage treatment work will serve 17 communities and part of Boston, having a combined population of nearly 1,166,000. One community needing a sewerage project has a population of 111,000; one sewerage district requiring improvements to the ocean outfall serves 84,400 persons; two communities with populations between 10,000 and 15,000 need projects; and six communities having populations ranging from 2,000 to 5,000 need projects. The remaining 26 sewage projects will serve sources contributing pollution from 1,000 persons or less, although most are located in cities and towns having larger populations.

The proposed program for abatement of industrial pollution will require at least 37 projects, 35 for the treatment or disposal of process wastes and two for the treatment of employee sewage. Some of the plants requiring process waste treatment will also require treatment for employee sewage but in these cases both are considered one project. Of these 37 projects known to be required, 14 are for construction of new industrial waste treatment plants; one manufacturing plant is required to enlarge present facilities for treatment of employee sewage; eight sources of industrial waste pollution will be required to construct facilities for connection to existing municipal sewers and one other plant requires a similar connection for employee sewage; 12 existing industrial waste treatment plants will be required to construct additions or enlargements; and one existing treatment facility needs to be replaced by an adequate waste treatment plant. These 37 industrial projects are required to treat wastes having a total population equivalent of nearly 60,000 persons.

Table 14 lists all of the municipalities, institutions and industries in the Massachusetts Coastal Streams Basin for which the pollution abatement needs have been determined. The names of manufacturing plants are not given in accordance with the established policy of the Massachusetts State Department of Public Health. Instead the location and type of industry are given. Map No. 5, which follows Table 14, shows the locations and types of projects to be required.

Table 14--Municipalities and Industries Needing Improvements for Abatement of Pollution--Date, February 1952

Name or Type of Industry and Location 1/	Population Served 2/	Improvements Needed and Remarks
Abington (T)		
N.Abington (V)	750	Replacement
Ice Cream Plant	280	Replacement

Table 14--Municipalities and Industries Needing Improvements for Abatement of Pollution--Date, February 1952 (Cont.)

Name or Type of Industry and Location 1/	Population Served 2/	Improvements Needed and Remarks
Acushnet (T)		
Golf Ball Manufacturing	216	New Plant
Barnstable (T)		
Fish and Cranberry Processing	N 3/	New Plant
Bellingham (T)		
Dye and Finish Wool	5,550	Additions
Beverly (C)		
Private Sewers	332	Individual Treatment or Connection to Municipal System
Boston (C)		
Boston Main Drainage	453,000	New Plant (one project jointly with North Metropolitan Sewerage District)
Bourne (T)		
Sagamore Apartments	125	Additions
Canton (T)		
Rubber Manufacturing	Does not apply	Connection to Municipal System
Chicken Slaughter House	100	Connection to Municipal System
Chatham (T)		
Commercial Laundry	N	Additions
Cohasset (T)		
Private Sewers	850	New Plant (Pretreatment and ocean outfall)

Table 14--Municipalities and Industries Needing Improvements for Abatement of Pollution--Date, February 1952 (Cont.)

Name or Type of Industry and Location 1/	Population Served 2/	Improvements Needed and Remarks
Danvers (T)		
Private Sewers	220	Individual Treatment or Connection to Municipal System
Everett (C)		
Coke Ovens	Does not apply	Additions
Gas Manufacturing	" "	Additions
Tar Refinery	" "	Additions
Oil Refinery	" "	Additions
Chemical Manufacturing	" "	Connection to Municipal System
Fairhaven (T)	9,000	New Plant
Tack Manufacturing	Does not apply	Additions
Franklin (T)	3,900	Additions
Felt Manufacturing	1,100	Pretreatment and Connection to Municipal System
Gloucester (C)		
East Gloucester	1,000	Connection to Municipal System (Extend Interceptors)
Magnolia Section	76	Individual Treatment (Private Sewers)
Holliston (T)		
Private Sewers	100	New Plant or Individual Treatment

Table 14--Municipalities and Industries Needing Improvements for Abatement of Pollution--Date, February 1952(Cont.)

Name or Type of Industry and Location 1/	Population Served 2/	Improvements Needed and Remarks
Hull (T)	2,170	Intercepting sewers and ocean outfall
Ipswich (T)		
Private Sewers	2,500	New Plant (Sewerage and Sewage Treatment Plant)
Old Veteran's Housing Project	100	Additions
Electrical Goods	170	Connection to Municipal System (Sanitary Sewage)
Kingston (T)		
Private Sewers	200	New Plant or Individual Treatment
Woolen Mill	2,550	New Plant
Laundry	100	New Plant
Rivets	Does not apply	New Plant
Malden (C)		
Gas Manufacturing	Does not apply	Additions
Manchester (T)	1,800	Additions (Comminutor)
Private Sewers	116	Individual Treatment or Connection to Municipal System
Marblehead (T)	10,800	Additions (Comminutor)
Private Sewers	332	Individual Treatment or Connection to Municipal System
Marshfield (T)		
Private Sewers	200	New Plant (Sewerage and Sewage Treatment Plant)

Table 14--Municipalities and Industries Needing Improvements for Abatement of Pollution--Date, February 1952(Cont.)

Name or Type of Industry and Location 1/	Population Served 2/	Improvements Needed and Remarks
Mattapoisett (T)		
Private Sewers	400	New Plant (Sewerage and Sewage Treatment Plant)
Medway (T)	200	New Plant
Woolen Mill	2,440	New Plant or Connection to Municipal System
Laundry	60	New Plant or Connection to Municipal System
Milford (T)		
Hat Manufacturing	75	Connection to Municipal System
Rubber-Coated Fabrics	25	Connection to Municipal System
Millis (T)		
Asphalt Shingles	Does not apply	New Plant
Nahant (T)	2,000	New Plant (Satisfactory Ocean Outfall)
New Bedford (C)	111,000	Additions (Intercepting Sewers)
Brass Mill	Does not apply	Connection to Municipal System
Norfolk (T)		
Pondville State Hospital	245	Chlorination
State Prison	900	Chlorination
North Metropolitan Sewerage District System	712,980	New Plant (one project jointly with Boston Main Drainage System)

Table 14--Municipalities and Industries Needing Improvements for Abatement of Pollution--Date, February 1952(Cont.)

Name or Type of Industry and Location 1/	Population Served 2/	Improvements Needed and Remarks
Peabody (C)		
Chemical Manufacturing	125	Connection to Municipal System
Plymouth (T)	11,000	New Plant
Cordage Manufacturing	1,040	Connection to Municipal System (Sanitary Sewage)
Provincetown (T)		
Fish Processing	N 3/	New Plant
Fish Processing	N 3/	New Plant
Rockland (T)	1,000	New Plant (Sewerage and Sewage Treatment Plant)
Private Sewers		
Rockport (T)	2,000	Additions (Comminutor)
Salem (C)		
Private Sewers	64	Individual Treatment or Connection to Municipal System
Sandwich (T)		
Fish and Cranberry Processing	N 3/	New Plant
Saugus (T)	4,390	Additions (Comminutor); Saugus discharged to Lynn outfall sewer)
Private Sewers	500	Connection to Municipal System
Scituate (T)		
Village-Private Sewers	400	New Plant (Sewerage and Sewage Treatment Plant)
Center-Private Sewers	200	New Plant (Sewerage and Sewage Treatment Plant)

Table 14--Municipalities and Industries Needing Improvements for Abatement of Pollution--Date, February 1952(Cont.)

Name or Type of Industry and Location 1/	Population Served 2/	Improvements Needed and Remarks
South Essex Sewerage District	84,400	Additions (Multiple Outlets)
Truro (T)		
Fish Processing	N 3/	New Plant
Walpole (T)		
Paper Mill	22,000	Additions
Paper Mill	12,000	Additions
Wareham (T)		
Laundry	340	New Plant
Weymouth (T)		
Wool Scouring	10,000	New Plant or Connection to Municipal System
Laundry	40	Additions
Dairy	100	Additions or Connection to Municipal System
Wilmington (T)		
Private Sewers	300	Individual Treatment
N.Wilmington (V)		
Tannery	1,250	Additions
Wrentham (T)		
State School	1,940	Chlorination
TOTAL	1,481,111	

1/ T - Town; C - City; V - Village

2/ For industries the organic waste load is expressed as population equivalent as measured by biochemical oxygen demand; N - Undetermined.

3/ Population equivalents not available--wastes result from processing fish 3-4 months per year, maximum of 40,000 pounds per day during fish season.

Table 14 shows an appreciable number of projects required in the present pollution abatement program of the State Department of Public Health. Based on 1950 construction cost indexes projected into 1952 cost levels, it is estimated that the capital outlay required for municipal and institutional pollution control projects required in this basin is approximately $57,000,000. Of this total, $50,000,000 is represented in the cost of works for the North Metropolitan Sewerage District and the Boston Main Drainage System.

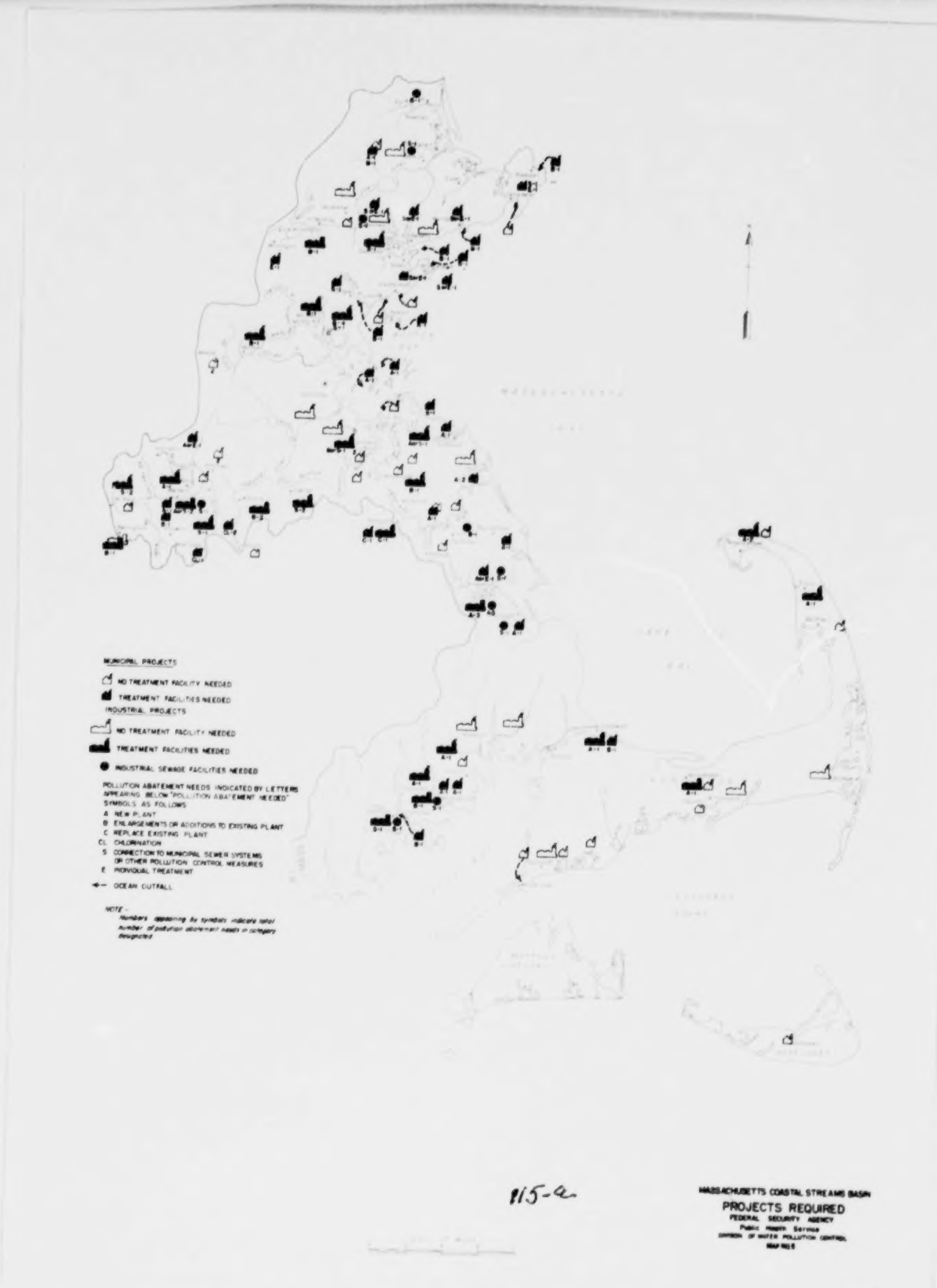
The number of persons to be served by the municipal and institutional sewage projects is approximately 1,421,500. The construction cost per capita for these projects is estimated to be about $40 on the average. However, based on modern methods of financing, the cost per capita over a period of thirty years would be $1.75 per year or slightly over the average New England worker's hourly wage.

The construction costs for the 37 industrial pollution control projects are estimated to be less than $1,000,000. Using this figure, however, and amortizing this cost over a period of 20 years at an interest rate of five percent, the cost to industry in the basin per year would be $76,250.

Much good work towards the formulation and completion of a comprehensive plan for the control and abatement of stream pollution has been accomplished and there is much that remains to be done. The success of such a planned program in the Massachusetts Coastal Streams Basin will depend in large measure on understanding of the problems involved, willingness to proceed to a satisfactory solution and wholehearted cooperation by the citizens, industries and regulatory agencies. This will require a well-rounded program for informing the public and industry in the needs for and the benefits to be derived from pollution abatement.

Under Part 9, "Benefits Resulting from Pollution Prevention and Abatement," 12 benefits from pollution prevention and abatement in the Massachusetts Coastal Streams Basin were cited. All of these benefits can be achieved if public support is given to a comprehensive program and a greater utilization of the water resources is developed. There is reason to believe that if the public and industry were informed through a sound program of education in the needs for and benefits from stream pollution prevention and abatement that support of a comprehensive program to attain that goal through good community planning would be forthcoming. A program of public education would weld together and reconcile the interests of private citizens, sportsmen's groups, social clubs, recreation interests, industrial groups and all State or other agencies concerned with the conservation and utilization of the water resources of the basin.

In addition to the many worthwhile benefits that can be accredited to water pollution control there is an undeniable moral obligation on the part of municipalities and industries to adequately treat


MUNICIPAL PROJECTS
NO TREATMENT FACILITY NEEDED
TREATMENT FACILITIES NEEDED
INDUSTRIAL PROJECTS
NO TREATMENT FACILITY NEEDED
TREATMENT FACILITIES NEEDED
● INDUSTRIAL SEWAGE FACILITIES NEEDED
POLLUTION ABATEMENT NEEDS INDICATED BY LETTERS APPEARING BELOW "POLLUTION ABATEMENT NEEDED" SYMBOLS AS FOLLOWS
A NEW PLANT
B ENLARGEMENTS OR ADDITIONS TO EXISTING PLANT
C REPLACE EXISTING PLANT
CL CHLORINATION
S CONNECTION TO MUNICIPAL SEWER SYSTEMS OR OTHER POLLUTION CONTROL MEASURES
E INDIVIDUAL TREATMENT
← OCEAN OUTFALL
NOTE -
Numbers appearing by symbols indicate total number of pollution abatement needs in category designated

MASSACHUSETTS COASTAL STREAMS BASIN
PROJECTS REQUIRED
FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 5

their wastes before discharge into public waterways.

Those who must contribute to and cooperate in a successful comprehensive program of pollution prevention and abatement in the Massachusetts Coastal Streams Basin are, in the last analysis, the beneficiaries and the number and extent of benefits derived therefrom will be measured by the total effort expended.

Part II

REPORT ON WATER POLLUTION

MASSACHUSETTS COASTAL STREAMS BASIN

1952

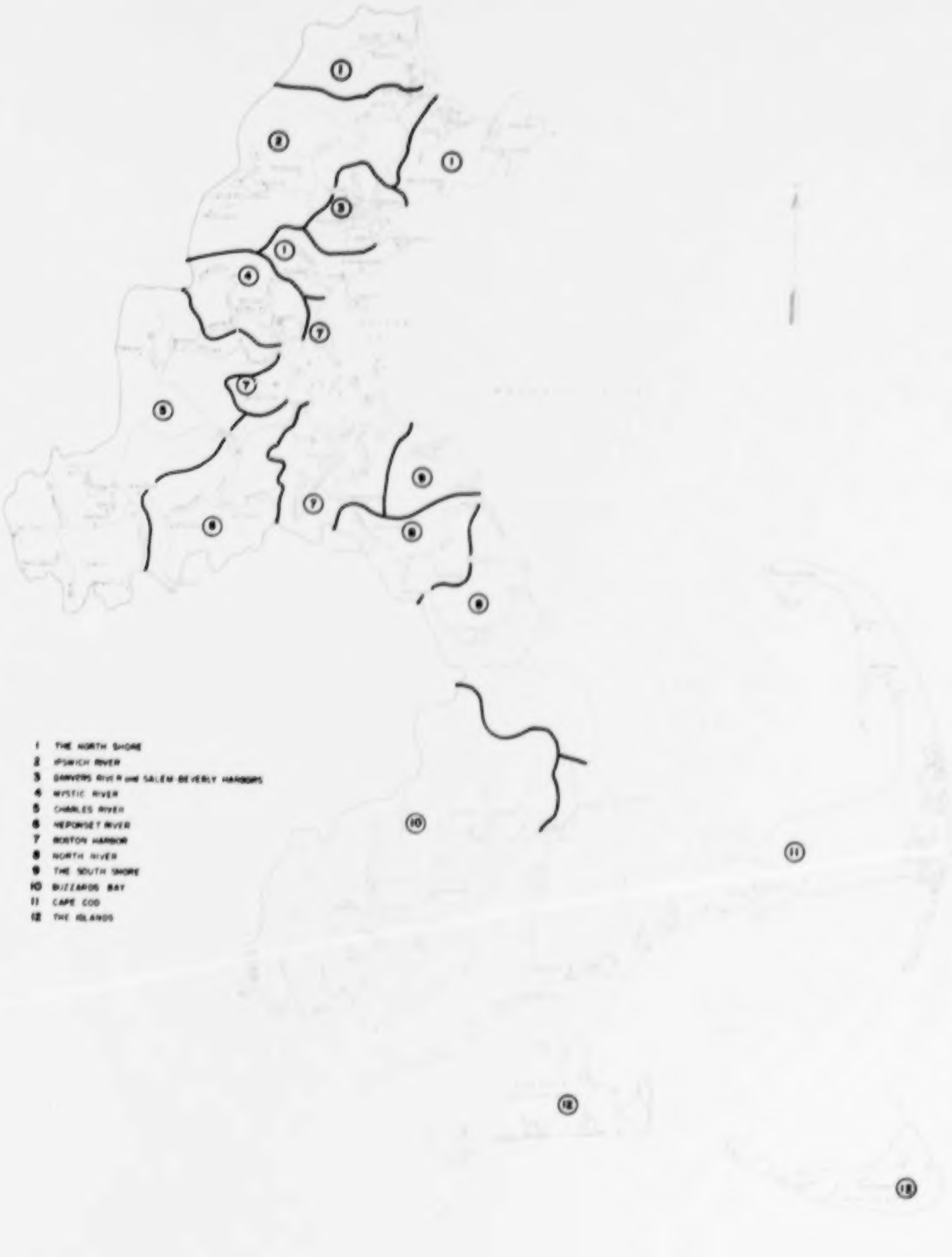
INTRODUCTION TO PART II

The Massachusetts Coastal Streams Drainage Basin has been divided into 12 sub-basin areas in the second part of this report. These sub-basin areas have been arbitrarily chosen for discussion on one of three bases: (1) The area is drained by one of the principal streams of the Massachusetts coast such as the Charles River; (2) the area is highly developed, densely populated and contains pollution problems common to the cities and towns involved, such as Boston Harbor; or (3) the area is less developed but has similar pollution problems to be solved by communities having like economic and social patterns, such as the South Shore or Cape Cod. The sub-basin areas are shown on Map No. 6.

The purpose of discussing these smaller sub-basin areas is to bring the problems of water pollution closer to the community and the individual by separating local problems from the whole of the Massachusetts Coastal Streams Basin. In the final analysis it is the community or individual responsible for pollution that is morally obligated to provide the pollution control projects needed to protect the water resources available to us all. The problems of pollution and the requirements for control are defined for each of the sub-basin areas chosen.

Pollution abatement is almost always accomplished on a local level and this is as it should be for there is where the responsibility for pollution problems rests. All too often, however, abatement is not undertaken until the polluter is compelled to take action by the Massachusetts Department of Public Health. Pollution is best controlled by concerted action of residents in drainage areas that are aware of the value of their water resources and the steps to be taken to preserve the usefulness of this important resource.

Although separated for purposes of defining local problems more clearly, no sub-basin should be considered apart from pollution in the Massachusetts Coastal Streams Drainage Basin as a whole. The water resources of the coastal area are limited because they must serve a very large population for a wide variety of purposes. Every person who is interested in the health and welfare of the residents along our coast and who bathes, swims and fishes in our water resources has a vital interest in the abatement of water pollution. The adoption of a comprehensive program of water pollution control by the citizens in the Massachusetts Coastal Streams Drainage Basin would result in the greatest benefits from use of the water resources to the largest number of people.



1 THE NORTH SHORE
2 IPSWICH RIVER
3 DANVERS RIVER and SALEM BEVERLY HARBORS
4 MYSTIC RIVER
5 CHARLES RIVER
6 NEPONSET RIVER
7 BOSTON HARBOR
8 NORTH RIVER
9 THE SOUTH SHORE
10 BUZZARDS BAY
11 CAPE COD
12 THE ISLANDS

MASSACHUSETTS COASTAL STREAMS BASIN
SUB - BASIN AREAS
FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 6

ARMY MED SECTION

Section .1

THE NORTH SHORE SUB-BASIN

General Description

The North Shore Sub-basin is comprised of the area north of the Revere-Saugus town line not drained by the watersheds of the Ipswich and Danvers Rivers systems. The total drainage area included in this sub-basin is approximately 195 square miles. The Parker, Essex and Saugus Rivers are the principal streams in the sub-basin and none has a drainage area of over 40 square miles.

The terrain is typically coastal lowland interspersed with swampland, numerous ponds and many low hills. The principal geologic feature is the granite bedrock formation that outcrops frequently. Cape Ann peninsula is composed almost entirely of granite, the quarrying of which was once a major industry in the sub-basin. About 50 percent of the area is in woodland of little value and approximately 20 percent is in farms of which about half is cleared land. Lakes, ponds and marshes cover about 15 percent of the sub-basin and the remaining 15 percent of the sub-basin is occupied by roads, factories, houses and other urban developments.

The 1950 population of the North Shore Sub-basin was estimated to be 184,000 of which 92.7 percent was accounted for by the urban cities and towns of Gloucester, Rockport, Marblehead, Saugus, Swampscott and Lynn. The sub-basin has experienced a small growth in population, about five percent, since the 1940 census was taken.

Manufacturing is by far the principal source of employment and income in this sub-basin. It is estimated that in 1947 the number of manufacturing employees averaged 25,000 and that their total wages approximated $67,500,000. The value added to products by manufacture during 1947 was an estimated $117,000,000.

The recreation industry probably produced the second largest income in the sub-basin. Almost the entire coastline has been developed for recreation and the area contains tourist attractions, resorts and seashore beaches. The exact recreational income is not known but is estimated to be several million dollars annually.

Agriculture accounts for about $2,500,000 of the sub-basin's income, approximately 60 percent derived from the sale of livestock and livestock products. Commercial fishing is a very important source of employment and income. The income of professional and service groups is not available but is probably several million dollars annually. Although not as important as in the past, the quarrying of granite produces a significant income.

Uses of the Water Resources

There is a wide and varied use made of the water resources of the North Shore Sub-basin. Public water supply is the primary water use and other important uses are for industrial water supply, livestock watering, shellfish propagation, navigation, game fishing, recreational bathing, boating, commercial fishing and transportation of sewage and industrial wastes.

The fresh water resources of this sub-basin are rather limited as the streams are small and subject to low run-offs during the warm months. The sub-basin enjoys extensive salt water resources which support important recreation, game fishing, wildlife, shellfishing, navigation and commercial fishing activities.

The water resources of the North Shore Sub-basin are probably the most important natural resource of the area.

Pollution Contributed to the Water Resources

Practically all of the pollution is discharged into the coastal waters of this sub-basin. The cities of Gloucester and Lynn and the towns of Manchester, Marblehead, Nahant, Rockport and Swampscott all have municipal sewerage systems that discharge into Massachusetts Bay and the Atlantic Ocean. The town of Saugus also discharges its municipal wastes to the ocean through the Lynn outfall sewer. In addition to the municipal systems, Gloucester, Manchester and Marblehead have sources of pollution from private sewers that discharge into nearby shallow coastal waters.

There are 149,374 persons served by municipal sewers that discharge into coastal waters. These systems also serve a large number of manufacturing and commercial establishments whose wastes materially increase the strength of the municipal sewage. The total pollutional load of municipal wastes discharged into the coastal waters from this sub-basin is computed to be equivalent to the domestic wastes from more than 450,000 persons.

Of the fresh water streams in the sub-basin, only the Parker and Saugus Rivers receive pollution. The Parker River receives minor pollution from sanitary sewage discharged from one tobacco products plant in Newbury. The Saugus River is seriously polluted by sewage discharged into it from private sewers in Saugus.

Aside from their effects on municipal sewage, there are no problems of pollution caused by industrial wastes in the North Shore Sub-Basin.

Damages to Water Resources from Pollution

Damages to the water resources of this sub-basin have been confined to the Saugus River and to the coastal waters. The Saugus

River receives sufficient pollution from private sewers in the town of Saugus to damage the water during the last two miles of its course for all purposes except limited industrial uses.

The damages to the coastal waters are to their use for recreational purposes and for shellfishing activities. Floating matter of sewage origin, discharged from municipal sewers without adequate pre-treatment and from private sewers discharging into shallow coastal waters, cause nuisances when washed onto the beaches of Marblehead, Manchester and Swampscott. While continued analyses have shown the coastal waters of the sub-basin to meet the standards of the Massachusetts Department of Public Health for safe bathing, these floating matters of sewage origin also must be considered as a potential hazard to the public health. This is especially important when bathing in unsupervised areas is practiced. The amount of bacterial pollution has been sufficient for the State health department to close clam flats to the harvesting of shellfish.

The Nahant municipal sewers and private sewers in Gloucester, Manchester, Marblehead and Saugus discharge into shallow waters near the shores. These sewage discharges not only create nuisance conditions along the shoreline, but they exist as a menace to the health of those who bathe along uncontrolled areas.

Recreation is very important to the economy of the North Shore Sub-Basin. Although nuisance conditions occur infrequently and the health hazards from sewage pollution may be remote, the permitting of continued pollution of these water resources is not in keeping with their value to the residents of the area.

Pollution Prevention Measures in Effect

All of the cities and towns have pre-treatment devices in operation preceding disposal of municipal sewage through ocean outfall sewers except the towns of Nahant and Saugus. The town of Swampscott has comminutors while Lynn, Marblehead, Manchester, Rockport and Gloucester all operate some type of screening equipment to remove coarse materials. Nahant and Saugus, which discharge to the Lynn outfall sewer, dispose of municipal wastes without treatment.

Only Lynn, Gloucester and Swampscott have provided adequate pre-treatment and have outfall sewers located such that disposal of municipal sewage is satisfactory for the present. Rockport, Marblehead, Manchester, Saugus and Nahant all require projects before municipal sewage disposal is adequate to control pollution.

Pollution Prevention Measures Required

There are ten sources of pollution in the North Shore Sub-Basin requiring projects to control damages to the water resources.

The city of Gloucester needs to connect the East Gloucester section to the municipal system and the residents of the Magnolia section need individual treatment at private outlets. The town of Manchester needs to install a comminutor on the outfall sewer and to connect private sewers to the municipal system or require adequate individual treatment at these private sources of pollution.

The towns of Marblehead, Rockport and Saugus each need to construct comminutors on outfall sewers. Saugus also needs to connect existing private sewers to the municipal sewerage system and Marblehead requires a similar project for private sewers or a requirement for adequate treatment at the source of these individual sources of pollution. Nahant needs to construct a satisfactory ocean outfall with adequate pre-treatment.

The only requirement for abatement of pollution by industry in this sub-basin is for adequate subsurface disposal of employee sewage by a tobacco manufacturing plant in Newbury.

Action to provide these needed pollution control projects is underway. Projects for individual sources of pollution from private sewers in Gloucester (Magnolia), Manchester and Marblehead are under construction. Also under construction are sewers and an ocean outfall at Nahant; a comminutor on the Saugus outfall sewer; and sewers to connect the East Gloucester section of the city to the municipal sewers. The town of Rockport has final plans approved for installation of a comminutor. The towns of Manchester and Marblehead have recently been requested by the State health department to take action to install comminutors on their ocean outfall sewers. The project to connect private sewers in Saugus to its municipal system is inactive. The tobacco plant in Newbury has been requested to take steps to provide adequate subsurface disposal of employee sewage.

It is estimated that the cost of the above projects at 1952 construction price levels would be about $280,000. There are nearly 65,600 persons residing in the municipalities requiring these projects and the cost of construction per capita would be about $4.25. However, based on modern methods of financing municipal projects, the cost to the individual over a period of 30 years would be less than 20 cents per year.

The cost of the projects needed to protect the water resources of the North Shore Sub-Basin is extremely small in relation to the high value of those water resources.

Table A1

BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION

North Shore Sub-basin

Source of Pollution & Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Watercourse	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
Parker River							
Newbury (T)							
--Tobacco Mfg. 4/	Sanitary only	5	None		5	Subsurface disposal	Action requested
Atlantic Ocean							
Gloucester (C)	18,000	60,400	Ocean outfall	S	60,400	None	
--E. Gloucester	1,000	6,000	None		6,000	Connection to M.S.	Under construction
--Magnolia	Private sewers	76			76	Individual treatment	Under construction
Lynn (C)	98,200	353,000	Ocean outfall	S	353,000	None	
Manchester (T)	1,800	1,800	Ocean outfall	U	1,800	Comminutor	Action requested
--Manchester (T)	Private sewers	116				Connection to M.S. or Individual treatment	Under construction
Marblehead (T)	10,800	10,800	Ocean outfall	U	10,800	Comminutor	Action requested
--Marblehead (T)	Private sewers	332			332	Individual treatment or Connection to M.S.	Under construction
Nahant (T)	2,000	2,000	None		2,000	Ocean outfall sewer	Final plans approved.
Rockport (T)	2,000	2,000	Ocean outfall	U	2,000	Comminutor	Final plans approved.
Saugus (T)	4,350	4,350	Ocean outfall 5/	U	4,350	Comminutor	Under construction
--Saugus (T)	Private sewers	500			500	Connection to M.S.	Inactive
Swampscott (T)	10,700	10,700	Ocean outfall	S	10,700	None	

1/ C - City; T - Town. 2/ P.E. - Population equivalent in terms of biochemical oxygen demand.

3/ S - Satisfactory; U - Unsatisfactory.

4/ Not counted as a source of pollution in report but project for employee sewage required under policy of the Massachusetts Department of Public Health.

5/ Discharges to Lynn outfall sewer.

Section .2

THE IPSWICH RIVER SUB-BASIN

General Description

The Ipswich River Sub-basin drains about 130 square miles of Essex County and about 20 square miles of Middlesex County, emptying into Plum Island Sound. The river has several small tributaries of which Black, Fish, Martins and Kimball Brooks are the largest.

The terrain is typical coastal lowland interspersed with considerable swampland, numerous ponds and many low hills. The bedrock formation is largely granite that outcrops frequently. About 50 percent of the area is in woodland of little value and approximately 20 percent is in farmland of which about half is cleared land. The remaining 30 percent of the sub-basin is accounted for by swamps, surface waters and urban developments.

The 1950 population of the Ipswich River Sub-basin was an estimated 65,240. The population increase from the 1940 census was over 7,000 persons, or about 11 percent. The town of Ipswich is the only urban center in the watershed and in 1950 the population was 6,877.

Manufacturing provides the largest source of employment and income although this sub-basin is not nearly as developed in this field as are the sub-basins which surround it. In 1947 it is estimated that industry employed an average of 5,000 employees whose salaries and wages totaled approximately $12,000,000. The value added to products by manufacture during 1947 was an estimated $21,100,000.

Agriculture probably produced the second largest income of the sub-basin. In 1945 it is estimated that the value of all farm products sold was $10,000,000 of which livestock and livestock products accounted for more than 60 percent.

Uses of the Water Resources

Although the water resources of this small river sub-basin are rather limited, these are an important natural resource. The salt water resources of the sub-basin are limited to the clam flats at the mouth of the river and to limited beaches along Great Neck, Little Neck and Castle Neck. The fresh water resources are not extensive but nevertheless serve the area importantly.

Th fresh water resources of the Ipswich River Sub-basin are used for public water supply, industrial water supply, livestock watering, game fishing, recreational bathing and transportation of sewage and industrial wastes. The salt water resources are used for shellfish propagation and recreational bathing and boating.

All of the small municipalities derive public water supplies from the ground water resources although Ipswich, the largest town in the sub-basin, takes part of its water supply from Dow and Bull Brooks. In addition, the Ipswich River serves in part as a source of water supply for Lynn and Peabody and for the Salem-Beverly Water Supply Board.

The natural resources of the Ipswich River Sub-basin are very limited and the water resources are probably most important to the future economy and welfare of the residents.

Pollution Contributed to the Water Resources

The Ipswich River and three of its tributaries, Martins, Farley and Lubber Brooks, receive sewage and industrial wastes. The town of Ipswich discharges municipal sewage into the Ipswich River from three sources—effluents from treatment plants at the Old Veterans Housing Project and the Veteran's Housing Project and from private sewers in the thickly settled portion of the town. Also in Ipswich a plant manufacturing electrical goods discharges the untreated sanitary wastes from more than 400 employees into the river. In Middleton, a plant manufacturing shoe and leather finishes discharges effluent from a satisfactory waste treatment plant.

Lubber Brook is heavily polluted by inadequately treated wastes from a tannery in Wilmington. Pollution of Martin's Brook results from overflowing private cesspools in the village of North Wilmington. In North Reading, Martin's Brook receives minor pollution from the secondary effluent of the State Sanitorium. Farley Brook is grossly polluted by sewage from private sewers.

Lubber Brook, Farley Brook and the last few miles of the Ipswich are seriously polluted. Sewage pollution in Ipswich has caused the closing of salt water flats to shellfishing and endangers bathing in nearby shore areas. Although pollution of Martin's Brook and Lubber Brook is somewhat remote, its existence above the public water supply intakes of Lynn, Peabody and the Salem-Beverly Water Supply Board constitutes a menace to the health of residents of those cities.

The total pollutional load exerted on the lower Ipswich River and three of its small tributaries is estimated to be equivalent to the domestic wastes from nearly 4,500 persons.

Pollution Prevention Measures in Effect

For the nine sources of sewage and industrial wastes pollution in the Ipswich River Sub-basin, seven treatment projects have been placed in operation. In Ipswich the two Veteran's Housing Projects have secondary sewage treatment plants in operation as has the State Sanitorium in North Reading. No treatment has been provided for sewage from private sewers serving as estimated 2,500 persons in Ipswich.

The tannery in North Wilmington operates a secondary waste treatment plant as does the shoe and leather finish plant in Middleton. The slaughterhouse in Ipswich has installed cesspools while the electrical goods plant in Ipswich discharges employee sewage untreated.

The treatment works provided by the North Reading State Sanitorium, Veteran's Housing Project in Ipswich, the slaughterhouse in Ipswich, and the manufacturing plant in Middleton all produce satisfactory effluents before discharging into watercourses. The treatment works at the Old Veteran's Housing Project in Ipswich, the cesspools in North Wilmington, and the waste treatment plant for the tannery in North Wilmington do not provide adequate treatment. The total pollutional load of untreated and inadequately treated wastes in the Ipswich River Sub-basin is estimated to be equivalent to the domestic wastes from over 4,000 persons.

Damages to Water Resources from Pollution

Pollution of the lower Ipswich River and of Farley Brook in the thickly settled portion of Ipswich has resulted in serious damages. Farley Brook is in nuisance condition during critical periods and unsuitable for any legitimate purpose. As the Ipswich River enters the built-up section of the town, private sewers pollute the river until it is unsuitable for any purpose except conveying wastes. After confluence with Farley Brook, the river is also in nuisance condition until sufficient salt water dilution is encountered to dissipate these conditions.

Lubber Brook is polluted by tannery wastes in an extent to damage this small stream for any other use except transporting these wastes. Martin's Brook is less seriously damaged by overflowing cesspools in North Wilmington. The waters in this brook are satisfactory for all purposes except public water supply without adequate filtration and disinfection, recreational bathing and irrigation of crops consumed raw.

Pollution of the water resources of the Ipswich River Sub-basin have been confined to three areas but nevertheless result in significant damages. Sewage and wastes pollution in the headwaters constitute a health hazard to bathing in these uncontrolled areas and limit the usefulness of the main stem for public water supply without the installation of expensive water treatment equipment. In the lower reaches of the river there is serious damage to the use of the water resources for recreation and shellfish operations and this constitutes a menace to the public health. At times nuisance conditions exist.

Pollution Prevention Measures Required

There are five projects required to control pollution of the water resources of the Ipswich River Sub-basin. The town of Ipswich needs to construct intercepting sewers and a new sewage treatment plant for private sewers now discharging into Farley Brook and the Ipswich River without treatment. The Old Veteran's Housing Project sewage plant requires additions to produce a satisfactory effluent. Private cesspools in North Wilmington, serving about 300 persons, need adequate subsurface disposal at each of these sources of pollution.

Two pollution control projects are needed by manufacturing plants. The electrical goods plant at Ipswich needs to connect plant sewers to the municipal sewerage system when that project is completed by the town and the tannery at North Wilmington needs additions to its existing secondary industrial waste treatment works.

The town of Ipswich has final plans approved by the State health department for sewers and sewage treatment plant. All of the other projects to be required in this sub-basin are inactive. More action is needed to be taken to provide the required pollution control projects by those who are responsible for these measures.

It is estimated that the cost of the above municipal sewage treatment projects at 1952 construction price levels would be about $1,200,000. There are approximately 7,180 persons who will be required to share in the costs of these needed facilities and the cost per capita would be about $167. However, based on modern methods of financing municipal construction projects, the cost per capita over a period of 30 years would be about $8.20 per year or 70 cents per month.

This is a very low cost in relation to the conservation of a valuable natural resource and to the health and welfare of the residents. However, these construction costs should not be considered as lost income but rather as an investment in the improvement of the properties to be served. The value of real estate to be served by these required sewerage and sewage treatment projects will be increased by these improvements far beyond their cost. Further, treatment must be provided for the sewage pollution, and municipal projects are much more satisfactory and less expensive than treatment undertaken by the individual householder.

Table A2
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
Ipswich River Sub-basin

Source of Pollution and Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Water-course	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
Ipswich River							
Ipswich (T)	Private sewers	2,000			2,000	New plant	Final plans approved
--Vet. Housing Project	200	200	Secondary	S	10	None	
--Old Vet. Housing Proj.	100	100	Secondary	U	25	Additions	Inactive
--Electrical Goods	Sanitary sewage	170	None		170	Connection to M.S.	Inactive
--Slaughterhouse	Food	(N)	Cesspools	S	2/ 0	None	
Middleton (T)							
--Shoe and Leather Finishes	Chemical	(N)	Secondary	S	31	None	
Farley Brook							
Ipswich (T)	Private sewers	500			500	New plant and Sewerage system 3/	Final plans approved
Lubber Brook							
Wilmington (T)							
N. Wilmington (V)							
--Tannery	Tannery	(N)	Secondary	U	1,250	Additions	Inactive
Martin's Brook							
N. Reading (T)							
--State Sanitorium	165	165	Secondary	S.	Neg.	None	
--Wilmington (T)	300	300	Private cesspools	U	200	Individual treatment	Inactive

1/ P.E. - Population equivalent in terms of biochemical oxygen demand; N undetermined.
2/ Effluent discharged to ground water; Neg. - Negligible.
3/ Private sewers shown for main stem of Ipswich River and for Farley Brook ~~to~~ be served by one sewerage system.

Section .3

THE DANVERS RIVER AND SALEM-BEVERLY HARBORS SUB-BASIN

General Description

The Danvers River and Salem-Beverly Harbor Sub-basin is comprised of the watersheds of the Danvers River and the other streams draining into Salem and Beverly Harbors. The total drainage area is approximately 35 square miles and the principal streams are the Danvers, Crane, Waters, North, Porter and Bass Rivers, all of which are largely tidal estuaries.

The sub-basin contains many low hills, none of which is more than 250 feet high, interspersed with occasional areas of level land, frequent swamps and water impoundments. Granite underlies most of the area and outcrops at frequent intervals. About 50 percent of the sub-basin is wooded and about 20 percent is in farmland. The remaining 30 percent of the area is accountable in swamps, surface waters and urban developments.

The 1950 population of the sub-basin was an estimated 109,000 indicating a population density of over 3,100 persons per square mile. The entire population is classified as urban and since the 1940 census the population growth was approximately six percent, less than the average for the Massachusetts coastal area.

The economy of this sub-basin is definitely geared to manufacturing which easily provides the largest source of employment and income. It is estimated that industry employed an average of 22,000 workers in 1947 whose total salaries and wages were approximately $66,000,000. It is estimated that the value added to products by manufacture during 1947 was $96,000,000.

Specialty farming accounts for an appreciable income and in 1945, the latest year for which data are available, income from the sale of farm products was about $2,000,000. The sub-basin contains a number of developed ocean beaches and recreation produces an appreciable income that is estimated in 1951 to have been more than a million dollars. Commercial fishing, service industries and the professional groups provide additional employment and income that annually amounts to several million dollars. The average annual income in the sub-basin is about average for the Massachusetts coastal area and higher than for the United States as a whole.

Uses of the Water Resources

The fresh water resources of the Danvers River and Salem-Beverly Harbors Sub-basin are very limited but there are extensive salt water resources. The water resources serve a wide variety of uses and are an important natural resource.

Important water uses are for industrial water supply, recreational bathing, boating, navigation, livestock watering, shellfish propagation, commercial fishing and transportation of sewage and industrial wastes.

Pollution Contributed to Water Resources

There are seven sources of pollution in the sub-basin discharged at five separate points. The South Essex Sewerage District outfall sewer, which serves 84,400 persons, discharges into Massachusetts Bay east of Great Haste Island. The Bass River receives pollution from private sewers in Beverly and from a plant manufacturing metal specialties.

Private sewers serving homes in Salem discharge into the shallow waters of Salem Harbor. The Danvers River has three sources of pollution, private sewers in Danvers and from two tanneries in the town, one discharging industrial wastes and the other employee sewage. The North River is polluted by wastes from a chemical manufacturing plant in Peabody.

All of the sources of pollution are relatively small except the discharge from the South Essex Sewerage District. Seven of the eight sources have a total pollutional load equivalent to the domestic sewage from approximately 406,600 persons, of which the District accounts for 406,000. The chemical wastes originating in Peabody have polluting effects not comparable to sewage.

Damages to Water Resources from Pollution

All of the sources of pollution contribute damages to the receiving watercourses. Although the South Essex Sewerage District outfall discharges a considerable distance off shore, adequate pretreatment of the daily 16 million gallons of sewage and industrial wastes is not given. As a result, materials of sewage origin are occasionally washed ashore on the beaches of Salem and Beverly which create nuisances and complaints. While analyses by the Massachusetts Department of Public Health show these waters to meet the department's standards for safe bathing, the existence of these conditions is a public health hazard, especially to those who bathe in uncontrolled areas.

Damages to Salem Harbor and the Danvers, Bass and North Rivers are also principally to the use of the waters for recreation purposes. With the exception of a part of the North River, the damages are to tidal waters with limited uses, principally for bathing, boating, shellfish propagation, commercial fishing, industrial cooling purposes and navigation. The discharge of untreated sewage into these waters constitutes a menace to the public health of those who bathe in uncontrolled areas or consume shellfish taken from restricted areas.

Although there are no data at hand, it could probably be shown that the pollution of these tidal waters increases the maintenance costs for commercial and pleasure boats by increased fouling of bottoms and deterioration of painted surfaces. Pollution probably contributes to the deterioration of waterfront structures.

Before recent improvements were made, damages to the water resources of the Danvers River and Salem-Beverly Harbors Sub-basin were far more extensive than at present. When the remaining projects are completed, a comprehensive program to safeguard this important resource will be in operation.

Pollution Prevention Measures in Effect

Of the eight separate sources of pollution remaining in this sub-basin, only three have been provided with treatment facilities and only one is satisfactory.

The South Essex Sewerage District has treatment facilities in operation at three places within the system but the amounts of pretreatment afforded is not adequate. At the Beverly pumping station, screens are provided and a grit and grease removal chamber is in operation on the trunk sewer just above the Salem pumping station. A large grit and grease removal chamber was placed in operation by the District in 1947 at the Salem-Peabody line. These facilities have accomplished a great deal of pollution abatement but additional treatment is needed before disposal in Massachusetts Bay will be satisfactory.

A small tannery in Danvers operates primary treatment facilities that are adequate for the small amount of wastes produced by this plant. The chemical manufacturing plant in Peabody has constructed primary treatment works but the reduction in pollution matter is not adequate and improvements are needed.

Pollution Prevention Measures Required

The South Essex Sewerage District needs to construct new screening devices at the Beverly pumping station and to install multiple outlets or some type of diffusing cover over the outfall off Great Haste Island. These improvements are needed to prevent floating matter originating in the sewerage system from accumulating on the beaches of Salem and Beverly.

Private sewers in Beverly, Salem and Danvers need to be connected to the municipal systems or, where this is not possible, adequate subsurface disposal at the sources of the pollution

The chemical manufacturing plant in Peabody operating an unsatisfactory treatment plant needs to abandon these works and connect the plant sewers to the municipal sewerage system. The tannery in Danvers, discharging untreated employee sewage, needs to connect plant sewers to the municipal sewers. The dilution afforded by the Bass River for the small amount of inorganic wastes discharged by the metal specialty manufacturing plant in Beverly is adequate for disposal of these wastes and no treatment project is indicated for the present.

Action to provide these needed pollution control measures is in progress. The State health department has requested the South Essex Sewerage District to proceed in constructing the required sewage disposal facilities. The other five pollution control projects are in an active planning stage, have final plans approved by the State health department, or are under construction.

Based on 1952 price levels for construction, it is estimated that the above municipal sewage projects would cost approximately $100,000. There are approximately 85,000 persons residing in the cities and towns to be served by these projects and cost of construction per capita would be about $1.20. If these projects are financed over a period of 30 years, however, the cost per capita would be only about five cents per year.

Where it is not possible to connect private sewers to existing municipal sewers, the cost will be higher because individual treatment will be needed. Depending on whether the work is contracted for or done by the home owner, the cost will vary upwards from $150.

Table A3
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
Danvers River and Salem-Beverly Harbors Sub-basin

Source of Pollution & Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Watercourse	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
Atlantic Ocean							
South Essex Sewerage District 4/	84,400	406,000	Ocean outfall	U	406,000	Multiple outlets	Action requested
Bass River							
Beverly (C)	Private sewers	332			332	Individual treatment or Connection to M.S.	Under construction
--Metal Hydrides	Chemical	Does not apply	None		Does not apply	None 5/	
Danvers River							
Danvers (T)	Private sewers	220			220	Individual treatment or Connection to M.S.	Under construction
--Tannery 6/	Sanitary sewage	15	None		15	Connection to M.S.	Active planning
--Tannery	Tannery	(N)	Primary	S	15	None	
North River							
Peabody (C) --Chemical Mfg.	Chemical	(N)	Primary	U	125	Connection to M.S.	Final plans approved
Salem Harbor							
Salem (C)	Private sewers	64			64	Individual treatment or Connection to M.S.	Under construction

1/ C - Cities; T - Towns
2/ P.E. - Population equivalent in terms of biochemical oxygen demand; N - Undetermined.
3/ S - Satisfactory; U - Unsatisfactory.
4/ Serves municipal systems in Salem, Beverly, Peabody and Danvers.
5/ Dilution satisfactory method of disposal for the present.
6/ Not counted as a source of pollution but project for employee sewage required under State health dept. policy.

Section 4

THE MYSTIC RIVER SUB-BASIN

General Description

The Mystic River rises in the town of Burlington and flows in a generally southerly direction for about 18 miles where it empties into Boston Inner Harbor. The basin drains all or a part of Burlington, Lexington, Woburn, Winchester, Melrose, Malden, Stoneham, Medford, Arlington, Somerville, Everett, Chelsea and the Charlestown section of Boston, a watershed area of approximately 65 square miles. The principal tributaries are the Aberjona, Malden and Chelsea Rivers and Alewife Brook.

The topography of the basin is uneven and features many low hills, most ranging in altitude from 100 to 200 feet, interspersed with swampland, lakes and ponds. The geologic feature of the sub-basin is the granite bedrock that underlies the area with frequent outcroppings.

About 20 percent of the watershed is in woodland of no commercial significance and some 10 percent is in cleared farmland. Approximately five percent of the area is covered by water or swamps and the remainder of the area is accounted for by roads, streets, houses and other urban developments.

The 1950 population of the Mystic River Sub-basin was an estimated 327,100. All of the cities and towns drained by the sub-basin were classified as urban except Burlington town. There was a small growth in population, approximately four percent of the 1940 census figures.

The Mystic River Sub-basin is definitely geared to manufacturing and is a part of the Boston standard metropolitan area. Somerville, Everett, Chelsea and Charlestown are large manufacturing centers and it is estimated that the sub-basin contains about 700 manufacturing plants of all types. In 1947 these plants employed approximately 43,000 persons, paid salaries and wages of some $96,000,000 and increased the value of goods through manufacture by about $173,000,000.

Although manufacturing in the sub-basin far exceeds any other source of income, the service and professional groups serving the large urban population account for many millions of dollars of the area's income. Agricultural income is significant, too, being an estimated $2,000,000 derived largely from the sale of truck garden produce. The average income in this urban area is higher than the average for Massachusetts and the nation.

Uses of the Water Resources

In this highly-populated region, there is a large and varied use made of the water resources available. Public water supply is the highest use made of the water resources although this use is somewhat limited since the Metropolitan Water District serves most of the population. Other widespread uses are for industrial water supply, recreational bathing and boating, game fishing, livestock watering, wildlife habitat, navigation and transportation of sewage and industrial wastes.

The Mystic Lakes are a popular recreation water resource and are used extensively for bathing, boating and fishing. There is also unsupervised bathing in other parts of the sub-basin. The tidal sections of the river and its tributaries accommodate considerable navigation and the large industries in these areas are dependent to a considerable extent on this mode of shipment for raw materials. The tidal estuaries also serve industry importantly as sources of industrial cooling waters.

The Mystic River Sub-basin is a part of the Boston metropolitan area where water resources, especially fresh water are already limited. The water available is a natural resource important to the health, welfare and economy of the area.

Pollution Contributed to the Water Resources

Counting overflows from the North Metropolitan Sewerage System sewers, there are eight separate sources of pollution in the Mystic River Sub-basin. Six sources of pollution are caused by industrial wastes and two are caused by overflowing sewers. Other than the overflowing sewers, there are no sources of municipal sewage pollution inasmuch as all of the sewered communities are served by the North Metropolitan District Sewerage System.

In Everett there are five large industrial plants which discharge a large volume of industrial wastes into the Mystic River and the Island End River. The pollution results principally from the discharge of waste products in the manufacture of coke and coke by-products, chemicals, oil refining, tar refining and artificial gas manufacture. The constituents of an objectionable nature in those wastes are oils, tars, acids, minerals and phenolic substances. The Malden River is polluted by artificial gas manufacturing wastes containing tars, oils, phenols and like substances. While some of these wastes are capable of depleting the oxygen in the receiving streams, their objectionable characteristics are mainly in the chemical effects that result from their discharge.

The Aberjona River is polluted by overflowing municipal sewers in Woburn. The number of persons contributing to this pollution is indeterminate but the effects on the downstream water quality is considerable. Alewife Brook is similarly polluted by overflowing District sewers in Arlington although recent improvements have lessened the seriousness of the pollution.

Damages to Water Resources from Pollution

Sewage entering the Aberjona River in Woburn damage the river for about two miles for all legitimate purposes except to convey this waste without nuisance. From this point the river recovers somewhat and by the time it enters the Upper Mystic Lake, it is suitable for all uses except public water supply without disinfection.

Sewage discharged from overflowing sewers in Arlington damages Alewife Brook and the Mystic River for use in recreational bathing and during critical periods the aesthetic value of the waters is deteriorated.

Oils, tars and other chemical wastes discharged into Island End River by the manufacturing plants in Everett damage the river for all legitimate uses and nuisance conditions prevail. These wastes are also discharged into the Mystic River at Everett, but damages to water quality are less serious since dilution is greater. However, at and below Everett, the downstream water quality is unsuitable for recreational bathing and phenolic substances have destroyed the value of thousands of dollars worth of live clams and lobsters suspended in the waters as a means of storage. Floating oils and tars create a fire hazard by accumulating under shore installations and increase the maintenance costs of commercial and pleasure craft by fouling bottoms.

The Chelsea River is damaged by pollution carried upstream by tidal action and the water is unsuitable for recreational uses. In years past, the disposal of trash and garbage into the river at the point of an old abandoned clay pit causes nuisance conditions during the warm months. Temporarily the river is polluted by sewage from the main trunk sewer of the North Metropolitan Sewerage District at East Boston which was disconnected to permit construction of a tunnel which will convey all of the sewage to be treated at a plant on Deer Island.

Pollution Prevention Measures in Effect

Four sources of industrial wastes pollution in Everett and the gas manufacturing plant in Malden all operate some treatment facilities. The by-product coke plant operates oil separators and gravity coke filters; the gas plant in Everett has a coke filter; the tar refinery uses tanks for skimming and settling tars, oils and sludges; the oil refinery maintains oil separators; and the gas plant in Malden operates oil separators and coke filter. None of these treatment devices is adequate and all effluents require further treatment before disposal in the Mystic, Malden and Island End Rivers will be satisfactory.

The large chemical manufacturing plant in Everett discharges its wastes without any treatment. There are no treatment works at the sources of pollution from overflowing sewers in Woburn and Arlington. The elimination of this sewage pollution does not require treatment at these points but requires sewers and pumping station of sufficient capacities to prevent overflows.

Pollution Prevention Measures Required

The chemical manufacturing plant needs to provide the necessary degree of pre-treatment for connection to the Everett municipal sewerage system and to connect plant sewers to that system. The plant management is actively planning this needed construction.

The oil refinery, tar refinery, gas plant and by-product coke plant require additions to existing treatment facilities to produce satisfactory effluents. These last four plants had surveys made by consulting engineers in 1949, but no reports or recommendations have been made available. There is no action being taken at present to construct these needed additions at these plants.

The gas plant in Malden needs to install additional treatment devices before a satisfactory effluent is produced for discharge to the Malden River which is a very small stream. No action on these needs is being taken at present pending the outcome of this company's plans to distribute natural gas and abandon gas manufacture except in emergencies.

The elimination of pollution of the Aberjona River in Woburn from overflowing sewers requires the construction of a relief sewer to carry away peak flows and storm waters. The recently completed Alewife Brook conduit is such a relief sewer but pollution of Alewife Brook from overflows in Arlington will not be eliminated until a pumping station on the line is completed. The Metropolitan District Commission is actively planning these required projects as a part of the overall sewer and sewage treatment works construction program now in progress.

When the above pollution abatement projects have been completed, the fresh water resources of the Mystic River Sub-basin should be suitable for every normal purpose except public water supply without disinfection. The tidal waters will be considerably improved. The control of floating oils, tars and chemicals will reduce the fire hazard to shore installations and the deterioration of these structures. The cost of maintenance of pleasure and commercial vessels using these waters will be reduced. Live lobsters and other sea foods stored underwater will not be destroyed. Nuisance conditions that have occurred occasionally will be eliminated. Remote as the menace may appear to be, the elimination of sewage pollution from the water resources is always a benefit to the general health and welfare.

Table A4

BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION

Mystic River Sub-basin

Source of Pollution and Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Watercourse	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
Mystic River Everett (C)							
--Coke Mfg. (part)	Coke oven	Does not apply	Oil separator; Coke filter	U	Does not apply	Additions	Inactive
--Gas Mfg.	Gas mfg.	Does not apply	Coke filter	U	Does not apply	Additions	Inactive
--Chemical Mfg.	Chemical	Does not apply	None		Does not apply	Connection to M.S.	Active
Island End River							
Coke Mfg. (part	Coke oven	Does not apply	Oil separator; Coke filter	U	Does not apply	Additions	Inactive
Tar Refinery	Tars & Oils	Does not apply	Skimming and Settling tanks	U	Does not apply	Additions	Inactive
Oil Refinery	Tars & Oils	Does not apply	Oil separators	U	Does not apply	Additions	Inactive
Aberjona River North Metropolitan Sewerage District (part)	Municipal sewage-N 4/	(Overflowing municipal sewers in Woburn)				Relief sewer	Active planning
Malden River Malden (C)							
--Gas Mfg.	Gas mfg.		Oil separators Coke filter	U	Does not apply	Additions	Inactive
Alewife Brook North Metropolitan Sewerage District (part)	Municipal sewage- 4/	(Overflowing MDC sewers in Arlington-Belmont)				Pumping station 5/	Active planning

1/ C - City. 2/ P.E. - Population equivalent in terms of biochemical oxygen demand.
3/ S - Satisfactory; U - Unsatisfactory. 4/ N - Undetermined. 5/ Alewife Brook conduit completed and in partial operation. Pumping station required for full use of relief conduit.

Section .5

THE CHARLES RIVER SUB-BASIN

General Description

The headwaters of the Charles River lie in the town of Hopkinton near the Rhode Island State line. The river flows generally northeast to east, pursuing a very tortuous, meandering course for 65 miles before emptying into Boston Harbor between Boston proper and the Charlestown section of the city. Because of its role in early American history, the Charles is one of the best-known rivers in America although it has a total drainage area of only 290 miles.

The sub-basin is topographically characteristic of coastal lowland, containing many low hills that are interspersed with swamps, lakes, and ponds. The bedrock formation underlying the area is principally granite that outcrops at frequent intervals. About 40 percent of the sub-basin is covered with woods of little value and some 20 percent is in farms of which less than half is cleared land. About five percent of the area is covered by water or swamps and the remaining 35 percent is accounted for in urban developments, particularly Metropolitan Boston.

The number of persons residing in the Charles River Sub-basin is estimated from the 1950 census to be 735,700, the urban communities accounting for more than 90 percent of the total. During the period 1940-1950, there was an increase in population of more than 10 percent.

Manufacturing is easily the largest source of employment and income. The Charles River drains a large percentage of the Boston standard metropolitan area. The sub-basin contains more than 2,000 manufacturing plants that employed an estimated average of 75,000 employees during 1947, the last year for which figures are available. Manufacturing plants paid approximately $201,000,000 in salaries and wages and added about $392,000,000 to the value of products by manufacture.

Although manufacturing provides the bulk of the income in the sub-basin, there are other important sources of income from service industries, commercial fishing, maritime commerce, agriculture and the professional groups. The per capita income in the Charles River Basin is estimated to be more than $1,500 at the present time. This is higher than the averages for Massachusetts and the Nation and comparable to incomes in similarly developed urban areas.

Uses of the Water Resources

The Charles River and its tributaries are an important natural resource, put to many uses by the residents of the area. Public water supply is the highest use and other important uses are for industrial water supply, recreational bathing and boating, power development, livestock watering, irrigation, game fishing, recharging ground water supplies and transportation of sewage and wastes.

The water resources in the Boston metropolitan area are limited and this greatly enhances the value of those which are available.

Pollution Contributed to the Water Resources

The Charles River and six of its tributaries receive pollution from sources of municipal and institutional sewage and from industrial wastes. This small river system receives a total of 21 separate discharges of pollution. Until recent pollution control measures were placed in effect, the Charles River Sub-basin was subjected to considerably more pollution than at present although the problem is still serious.

The main stem of the Charles River receives 12 separate discharges of pollution, four effluents from municipalities, one effluent from an institution, effluents from two industrial waste treatment plants and untreated wastes from five manufacturing plants. The total pollutional load exerted by these treated and untreated wastes is equivalent to the domestic wastes from approximately 12,100 persons.

Mine Brook receives pollution from the Franklin sewage treatment plant and from a felt manufacturing plant in the town. These wastes have a combined population equivalent of 1,850 persons. A negligible amount of organic pollution is discharged into the Stop River by effluents from the Pondville State Hospital, Wrentham State School and Norfolk State Prison sewage plant effluents. However, the bacteriological quality of this small stream is impaired and chlorination is needed to safeguard water quality downstream from these institutions.

An unnamed brook in the town of Millis is seriously polluted by wastes from the manufacture of asphalt shingles. Another unnamed brook in Weston receives insignificant pollution from the sand filter effluent of the Regis College treatment plant. Pollution of Cherry Brook in Weston by the sewage plant effluent from Weston College is also negligible. Bogastow Brook is seriously polluted by sewage from private sewers that serve about 100 persons in the town of Holliston.

Although not counted as separate sources of pollution because of their relation to the whole problem of pollution in the Metropolitan Boston area, the Charles River is seriously polluted by overflowing Metropolitan Sewerage District sewers in Brighton, Brookline, Newton and Watertown. The amount of this pollution is indeterminate inasmuch as overflows result during storms and periods of high discharges by users. Overflows occur frequently and this pollution contributes most to the considerable deterioration of the Charles River below Waltham.

Pertinent data on sources of pollution are given in Table A5.

Damages to Water Resources from Pollution

Damages to the water resources from pollution are greatest to the main stem of the Charles River below Waltham. A paper plant in Waltham and overflowing sewers contribute sufficient pollution to damage the river for ten miles to its mouth in Boston Harbor for almost all uses during critical periods except transportation of these wastes. The water quality is unsuitable for public water supply, recreational bathing, game fishing, some industrial processes without treatment and during periods of low flow the aesthetic quality of the water is very low. This stretch of the Charles River once served the water recreation needs of thousands of persons but sewage pollution resulted in action by the State health department to close these waters to bathing as a public health measure. To replace bathing areas lost through pollution, the Parks Division of the Metropolitan District Commission is constructing artificial swimming pools along the Charles River. This is a very expensive substitute for bathing in the Charles Basin and the number of persons these pools can accommodate is limited. The damages to the recreational and aesthetic values of this very important metropolitan water resource are indeterminate in dollars but if calculable would be tremendous.

The Charles River is damaged almost at its source by the effluent from the Milford sewage treatment plant and two sources of industrial wastes in the town. Successive discharges of wool scouring and woolen textile wastes in Bellingham, woolen textile wastes and domestic sewage in Medway, Millis sewage plant effluent, and Medfield State Hospital sewage plant effluent prolong the effects of pollution for about 11 miles. From Milford to a point below Medfield, the water quality of the Charles River is unsuitable for public water supply without coagulation, filtration and disinfection; for recreational uses except boating; for some industrial processes without treatment; and for irrigation of crops consumed without cooking. During critical periods the aesthetic quality of this stretch of water is not always suitable.

The small unnamed brook in Millis is in a nuisance condition for about two miles as a result of pollution from wastes discharged in the manufacture of asphalt shingles. Bogastow Brook is damaged by sewage from private sewers in Holliston, the Stop River by unchlorinated effluents from three institutions, and Mine Brook by unsatisfactory effluent from the Franklin sewage plant and untreated felt manufacturing wastes. The water quality of these last three streams is not suitable for public water supply without coagulation, filtration and disinfection; for some industrial processes without treatment; for recreational uses except boating; and for irrigation of crops consumed without cooking.

In Weston town, Cherry Brook and a small unnamed brook are relatively undamaged by effluents from two college sewage treatment plants and the quality of water is suitable for all purposes except for use as public water supply without disinfection.

Until recent improvements were made and the amount of pollution discharged considerably reduced, the damages to the water resources were even more serious than at present. The unsatisfactory condition in the Charles River that now exists below Waltham once extended almost to Milford, a watercourse distance of about 60 miles. Chicken Brook was once in nuisance condition below a wool shoddy plant. Pollution abatement measures upstream have reduced the serious pollution of the Charles to the last 10 miles of the river's flow. For about 11 miles below Milford the river has recovered to be suitable for a number of purposes. From this point to Waltham, a water distance of about 44 miles, analyses now show the Charles River to be suitable for all purposes except for drinking without disinfection. This last is also the condition now existing in Chicken Brook.

The above demonstrates what can be accomplished by pollution control. Abatement measures have resulted in the reclaiming for almost every water use for two-thirds of the Charles River and eliminated a nuisance on Chicken Brook. Such rewards are not always attained but worthwhile benefits are always possible through a well planned pollution control program. The water resources of the Charles River Sub-basin are a very important asset to a highly congested metropolitan area and every effort to reclaim and safeguard these waters should be made.

Pollution Prevention Measures in Effect

Disregarding the metropolitan area, all of the communities in the Charles River Sub-basin having municipal sewerage systems have treatment plants in operation except Medway. Medfield, Millis, Franklin and Milford all have secondary sewage treatment works and all are satisfactory except that of the town of Franklin. There are six institutions in the watershed and all are served by secondary sewage treatment plants. The Regis College, Weston College and Medfield State Hospital plants are all adequate but effluents from the Pondville State Hospital, Norfolk State Prison and Wrentham State School all require chlorination to safeguard the bacteriological quality for downstream users. The untreated wastes entering these ten treatment plants have a population equivalent of 51,000 persons which is effectively reduced by treatment to only 1,310 persons, a reduction of nearly 97.5 percent.

Only two industrial plants in the sub-basin operate plants for the treatment of process wastes. In Bellingham, a wool-scouring plant provides an intermediate degree of treatment that is satisfactory until a better method of treatment is devised and a woolen textile plant has a primary treatment plant that does not provide a satisfactory effluent. Before treatment the wastes from these two plants have a total population equivalent of 12,000 persons which is reduced by treatment to only 8,650 persons.

Nine sources of pollution from sewage and industrial wastes are discharged directly to watercourses without treatment and these have a combined population equivalent of 4,150 persons.

Pollution Prevention Measures Required

There are 14 sources of pollution in the Charles River Subbasin that require projects to control pollution of the water resources and this does not include overflowing Metropolitan District sewers that are a part of another project.

The Pondville State Hospital, Norfolk State Prison and Wrentham State School all require the installation of chlorinators to reduce bacteriological pollution downstream and plans to accomplish these projects are in progress. The town of Franklin requires additional treatment units to produce a satisfactory effluent and plans for these additions are underway. The town of Medway is actively planning the construction of a municipal sewage treatment plant. Holliston needs a study of its sewage problems and to construct a municipal sewerage system and treatment works or to require treatment by subsurface disposal of the private sources of sewage pollution in the town. No action has been taken by the town to provide for its sewage treatment needs.

No action is being taken by the woolen textile plant in Bellingham to provide needed additions to its existing industrial waste treatment plant. The woolen mill and laundry in Medway need to construct new treatment facilities or plan to connect plant sewers to the municipal sewers. The hat and rubber-coated textile manufacturing plants in Milford will be required to connect to the municipal system. None of the industrial plants requiring projects in Medway and Milford have taken action to meet their needs.

The paper mill in Waltham needs to complete its closed white water system and this project is under construction. The felt manufacturing plant in Franklin requires pre-treatment of its wastes and their connection to the municipal sewers for which construction the company has final plans approved by the State health department. The asphalt shingle plant in Millis will be required to build a new industrial waste treatment plant and the status of this project is active.

The remaining seven sources of pollution in the sub-basin require no projects as each is served by treatment facilities that are satisfactory for the present. The overflowing sewers in Brighton, Newton, Waltham and Brookline are a part of the Metropolitan District Commission's program to abate pollution of Boston Harbor.

The three municipal sewage treatment projects to be required in the Charles River Sub-basin will cost, at 1952 construction price levels, an estimated $145,000 to $230,000, depending on the final needs established. There are 15,500 persons residing in the municipalities requiring these projects and the construction costs per person would probably be $10 to $15 on the average. However, such projects are usually financed by municipal bonds and with this method of modern financing of municipal construction the average cost to the individual over a period of 30 years would be from 40 cents to about 70 cents.

This is a very small cost to protect a very valuable water resource, especially in relation to the benefits to be gained.

Table A5
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
Charles River Sub-basin

Source of Pollution and Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Watercourse	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
Charles River							
Bellingham (T)							
--Wool Scouring	Wool Scouring	5,000	Intermediate	S	3,100	None	
--Wool Dyeing & Finishing	Wool Dyeing	7,000	Primary	U	5,550	Additions	Inactive
Medfield (T)	500	500	Secondary	S	50	None	
--Medfield State Hosp.	2,300	2,300	Secondary	S	55	None	
Medway (T)	200	200	None 4/		200	New plant	Active planning
--Woolen Mill	Dyeing and Finishing	2,440	None		2,440	New plant or Connection to Municipal System	Inactive
--Laundry	Laundry	60	None		60	New plant or Connection to Municipal System	Inactive
--Metropolitan District Sewerage System	Municipal Sewage--N 5/	(Overflowing sewers in Brighton, Brookline, Newton and Watertown)				Relief sewers	Active planning
Milford (T)	9,000	38,350	Secondary	S	390	None	
--Hat Manufacturing	Dye	75	None		75	Connection to Municipal System	Inactive
--Rubber Coated Textiles	Dye	25	None		25	Connection to Municipal System	Active
Millis (T)	200	85	Secondary	S	2	None	

[1/] C - City; T - Town.

[2/] P.E. - Population equivalent in terms of biochemical oxygen demand.

[3/] S - Satisfactory; U - Unsatisfactory

[4/] Emergency chlorinator installed in summer 1951.

[5/] N - Undetermined.

Table A5 (Continued)
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
Charles River Sub-basin

Source of Pollution and Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Watercourse	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
Charles River (Cont.)							
Waltham (C)							
--Paper Mill	Paper	150	None		150	Additions 4/	Under Construction
Mine Brook							
Franklin (T)	3,900	5,870	Secondary	U	750	Additions	Active planning
--Felt Manufacturing	Felt	1,100	None		1,100	Pretreatment and Connection to Municipal System	Final plans approved
Stop River							
Norfolk (T)							
--Pondville State Hosp.	245	245	Secondary	U	4	Chlorination	Active planning
--State Prison	900	900	Secondary	U	7	Chlorination	Active planning
Wrentham (T)							
--State School	1,940	1,940	Secondary	U	13	Chlorination	Active planning
Bogastow Brook							
Holliston (T)	100	100	None		100	New plant or Individual treatment	Inactive
Unnamed Brook							
Millis (T)	Asphalt	Does not apply	None		Does not apply	New plant	Active
Weston (T)							
--Regis College	475	475	Secondary	S	24	None	
Cherry Brook							
Weston (T)							
--Weston College	270	270	Secondary	S	14	None	

1/ T - Town; C - City. 2/ P.E. - Population equivalent in terms of biochemical oxygen demand.
3/ S - Satisfactory; U - Unsatisfactory. 4/ Closed white water system.

Section .6

THE NEPONSET RIVER SUB-BASIN

General Description

The Neponset River has its beginning in Neponset Reservoir in the town of Foxboro which lies southwest of Boston. The river follows a winding course in a northeasterly direction for about 28 miles before emptying into Dorchester Bay in Boston Harbor. The natural watershed is comprised of about 115 square miles but Mother Brook diverts the drainage from about 55 square miles of the Charles River watershed to the Neponset in Dedham and the main stem below that point actually carries run-off from an area of 170 square miles.

The watershed is typical of coastal lowland. The area contains many low hills interspersed with many small lakes and ponds and much marshy, low ground. Included in the Neponset River Sub-basin is the beautiful Blue Hills Reservation. The principal geologic formation is the granite bedrock which underlies the area and outcrops frequently. About 50 percent of the sub-basin is covered with woodland of little commercial but considerable scenic value. Approximately 25 percent of the area is in farms of which less than half is in cleared land. Lakes, ponds and swamps cover about 10 percent of the sub-basin and urban developments account for the remaining 15 percent of the area.

From the 1950 census figures it is estimated that the present population residing within the watershed is about 187,000 persons. More than 95 percent of the population has been classified as urban. Manufacturing leads all other sources of employment and income by a large margin. It is estimated that there are more than 400 manufacturing plants in the sub-basin that employed an average of 21,600 persons in 1947, the last year for which data are available. These plants had an estimated payroll of $58,000,000 and added through manufacture a value of $106,000,000 to products in 1947.

The service and professional groups, catering to the large urban population, probably accounted for the second largest source of employment and income. The income of these groups is not known but based on per capita income, it probably exceeds $20,000,000 annually. Agriculture produced a significant income which in 1945 was an estimated $3,000,000. Persons employed outside the basin account for the remainder of the estimated $261,800,000 annual income of the residents.

Uses of the Water Resources

The Neponset River Sub-basin is another of the small watersheds serving the Boston metropolitan area. The water resources in this congested area are limited and this enhances the value of those that are available.

This valuable natural resource has been put to many uses in the past, some of which have limited present usefulness. Although not much of the water resources are used for this purpose, public water supply is the highest water use made. Other important uses are for industrial water supply, power development and livestock watering. Limited use is made for recreational bathing and game fishing. The Neponset River is put to large use for the transportation of industrial wastes and it is this use that limits the other water uses to a large extent. The Neponset River is one of the most polluted streams in the Commonwealth.

The water resources of the Neponset River Sub-basin are the most important natural resource in the area and yet pollution has greatly curtailed the usefulness of this stream.

Pollution Contributed to the Water Resources

The number of sources of pollution remaining in the Neponset River Sub-basin is small but their effect on the water quality is considerable. The largest amounts of pollution are discharged into the river in the town of Walpole and from this point to its mouth, the river is seriously impaired for most uses. The East Branch (Canton River) is the largest tributary and it receives considerable pollution in the town of Canton.

At Walpole the river is heavily polluted by wastes from two paper mills that have a pollutional effect similar in magnitude to the domestic sewage from 34,000 persons. The river again receives paper mill wastes in small amount in the Hyde Park section of Boston.

There are two sources of pollution on the East Branch of the Neponset River in Canton. A chicken slaughterhouse operates cesspools to dispose of industrial wastes but these overflow into the stream and cause serious pollution. A rubber manufacturing plant discharges wastes from painting processes used. The paint wastes are small in volume but they contribute substantially to the unsatisfactory conditions of the East Branch.

Damages to the Water Resources from Pollution

Damages to the water resources of the Neponset River Sub-basin are confined to the main stem of the river and to the East Branch, but these are the most important waters in the watershed.

From the Foxboro State Hospital to Bird Pond in Walpole, the effluent from the hospital sewage treatment plant causes sufficient pollution to make the Neponset River unsuitable for public water supply without adequate coagulation, filtration and disinfection and for use in recreational bathing. Also the water quality is unsuitable for irrigating crops consumed without cooking.

In Walpole the main stem of the Neponset River is heavily polluted by paper mill wastes and a small amount of paper mill wastes is discharged in Hyde Park. From Walpole to the river's mouth, the water quality is unsatisfactory for all uses except power development and limited industrial purposes. During the warm months the river is in nuisance condition and complaints of odors and visual nuisance are often registered.

Below the chicken slaughterhouse and above the rubber products manufacturing plant, the East Branch is unsuitable for public water supply without coagulation, filtration and disinfection or for recreational uses except boating. The water in this stretch is not always of good aesthetic quality. Below the rubber plant the water for about one-half mile is unsuitable for all purposes except transporting wastes and for limited industrial uses. After this stretch, the stream recovers somewhat and becomes suitable for all purposes except public water supply and recreational bathing.

Recent improvements have somewhat reduced the pollution of the Neponset River and East Branch, but the remaining sources of pollution still contribute to a very serious pollution problem. Steps are needed to reclaim the full usefulness of this water resource which flows past much valuable residential real estate.

Pollution Prevention Measures in Effect

There are no municipal sewage treatment plants in operation in the Neponset River Sub-basin; all cities and towns in the watershed are served by Metropolitan District Commission sewers or have no municipal sewerage systems.

The Foxboro State Hospital operates a secondary sewage treatment plant that produces a satisfactory effluent.

All five of the sources of industrial wastes have treatment facilities in operation but none is satisfactory except those of the paper mill in Hyde Park. This mill provides minor treatment for the small amount of wastes it discharges into the Neponset River and dilution at this point is sufficient for this method of disposal to be satisfactory for the present.

The two paper mills in Walpole and the rubber products plant in Canton provide primary treatment of wastes and the chicken slaughterhouse operates cesspools. None of these treatment facilities provide a satisfactory degree of treatment and all require improvements to control pollution of the Neponset River and its East Branch.

Pollution Prevention Measures Required

The two paper mills in Walpole both require additions to existing inadequate primary treatment facilities. These two plants contribute almost 100 percent to the gross conditions of pollution existing in the main stem of the Neponset River. No action to construct these needed additions is being taken by either of these large industrial plants.

The chicken slaughterhouse and rubber plant in Canton need to be connected to the municipal sewerage system to eliminate pollution of the East Branch. The Massachusetts Department of Public Health has requested these two plants to begin action to connect plant sewers to the Canton sewerage system.

What the industrial waste treatment projects will cost the two paper mills to construct will depend on what methods of treatment are decided upon. Industrial waste treatment is a production cost that can almost always be borne without undue financial hardship. What is needed now is action by these two plants to determine suitable methods for treatment of their particular wastes. The costs to connect to municipal sewers will be low for the two plants in Canton.

The benefits to be gained by pollution abatement are significant and certainly the river should not be allowed to remain in its present nuisance condition. The Neponset River is a valuable water resource in a highly congested metropolitan area and the severe damages to its water quality represent a real loss to those who would otherwise benefit from its use.

Table A6
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
Neponset River Sub-basin

Source of Pollution and Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Watercourse	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
Neponset River							
Boston (C) (Hyde Park)							
--Paper Mill	Paper	N	Minor	S	140	None 4/	
Foxboro (T)							
--Foxboro State Hosp.	1,500	1,500	Secondary	S	26	None	
Walpole (T)							
--Paper Mill	Paper	N	Primary	U	22,000	Additions	Inactive
--Paper Mill	Paper	N	Primary	U	12,000	Additions	Inactive
East Branch							
Canton (T)							
--Chicken Slaughter-house	Food Paper	N	Cesspools	U	100	Connection to Municipal System	Action requested
--Rubber Mfg.		Does not apply	Primary	U	Does not apply	Connection to Municipal System	Action requested

1/ T - Town; C - City.
2/ P.E. - Population equivalent in terms of biochemical oxygen demand. N - Undetermined.
3/ S - Satisfactory; U - Unsatisfactory.
4/ Save-alls on all paper machines, satisfactory treatment at present; 22,000 gal/day white water overflows to river, remaining 1.22 M.G.D. white water to public sewers.

Section .7

BOSTON HARBOR SUB-BASIN

General Description

The Boston Harbor Sub-basin is comprised of a series of small streams, largely tidal estuaries. Included in this sub-basin are all the watersheds draining into Boston Harbor except those of the Charles, Mystic and Neponset Rivers which have been treated separately in this report. The total drainage area included in the Boston Harbor Sub-basin is approximately 140 square miles. The largest streams in the defined watershed are the Weymouth Fore, Weymouth Back and Weir Rivers, none of which has a drainage area greater than 35 square miles.

Topographically, the sub-basin contains many low hills, some of which are a part of the beautiful Blue Hills Reservation. Like most coastal lowland, there are frequent lakes and ponds and much marshland. The principal geologic formation is the granite bedrock underlying most of the area, outcropping very frequently. About 35 percent of the sub-basin is covered by woodland of little other than scenic value and another 20 percent is in farms. Ponds, lakes and marshes cover about 10 percent of the area and the remaining 35 percent is occupied by roads, buildings and other urban developments.

The 1950 population of the Boston Harbor Sub-basin is estimated to be nearly 780,000, almost all being in the Metropolitan Boston area. The largest municipalities all, or partly, in the drainage area are Boston, Quincy, Weymouth, Braintree, Milton, Hull, Revere, Everett and Winthrop. From the standpoint of pollution of Boston Harbor, however, the population contributing to this pollution is much higher. There are 33 cities and towns served by the Metropolitan District Commission sewers which discharge into Boston Harbor. The "pollution" population of the Boston Harbor Sub-basin is more than 1,800,000.

Manufacturing leads all other sources of employment and income but is closely followed by the income of the professional and service groups. It is estimated that about 100,000 persons residing in the sub-basin are employed in manufacturing plants and that in 1947 their combined wages and salaries totaled some $290,000,000. The value added to products by manufacture was an estimated $558,000,000. The incomes of the service, professional and self-employed groups are not available but from per capita income data, it was probably near the income of manufacturing employees. Agriculture is far behind as an income producer but the approximately $3,700,000 annual revenue from the sale of farm products is significant nevertheless. Commercial fishing activities provide considerable employment and a multi-million dollar income annually. In Quincy, the quarrying of granite has long been an important industry that produces several million dollars income each year. Recreation is also significant to the sub-basin economy. The per capita income in the Boston Harbor Sub-basin is probably appreciably higher than the average of $1,417 for the State as a whole and much higher than for the average for the United States.

Uses of the Water Resources

Although not used in large amount, the highest purpose the water resources serve is for public water supply. Other important water uses are for industrial supply, livestock watering, game fishing, commercial fishing, shellfish propagation, navigation and to a very large extent for recreation.

The fresh water resources are rather limited as the streams are small and subject to low flows during dry periods of even short duration. The sub-basin has extensive salt water resources important to recreation, navigation, commercial fishing, shellfish propagation and industry in general.

Compared to the number of persons to be served, the water resources in the Boston Harbor Sub-basin are very limited and this greatly enhances the value of the waters available.

Pollution Contributed to the Water Resources

Pollution in the Boston Harbor Sub-basin is discharged into Boston Harbor, Weymouth Fore River and its tributary Cochato River, Weymouth Back River, Mill River and Weir River. Boston Harbor is also affected by pollution transported into it by the Mystic, Charles and Neponset Rivers.

The largest amount of pollution by far is discharged directly into Boston Harbor by the North and South Metropolitan Sewerage Districts, the Boston Main Drainage System and wastes from detergent manufacturing. Metropolitan municipal sewers also intercept wastes from hundreds of manufacturing plants and the total pollutional load discharged into the Harbor is equivalent to the domestic sewage from approximately 2,692,500 persons. Pollution carried by the Mystic, Charles, and Neponset Rivers adds many thousands to the population equivalent of pollution entering Boston Harbor. It is not difficult to see that this amount of wastes has resulted in a critical water pollution problem that has faced the authorities for many years.

There are three small sources of pollution discharged into the Weymouth Fore River, effluent from the Homestead School sewage treatment plant, overflowing cesspools serving a dairy in Weymouth and effluent entering the Cochato River from the Norfolk County Hospital sewage plant in Randolph. The combined population equivalents of these wastes total about 140 persons.

The Weymouth Back River is seriously polluted by untreated wool scouring wastes from a plant in Weymouth. The Mill River, a tributary to the Weymouth Back, receives pollution from the secondary effluents of the treatment plants serving the South Shore Hospital and a commercial laundry in Weymouth.

The Weir River is polluted by untreated sewage discharged into it from municipal sewers in the town of Hull. Municipal sewers in the town also discharge into the Atlantic Ocean and the total pollution from Hull is contributed from an estimated 2,170 persons.

The most serious problem of pollution affecting the largest number of persons is, of course, the pollution of Boston Harbor. The fresh water resources are limited in this area, however, and even minor pollution of these small streams can result in a menace to the public health, local nuisance conditions during critical periods of low flow and warm temperatures, lowered aesthetic values, and other problems resulting from water pollution.

Damages to Water Resources from Pollution

Damages have been most extensive to the waters of Boston Harbor and the pollution of this valuable water resource. The "front door" to many cities and towns has long been the cause of frequent complaints. Damages to Boston Harbor from pollution equivalent to the domestic sewage from more than 2,690,000 persons have been manifold. Extensive shellfishing areas have been condemned and shellfish can be harvested from others only if taken to Newburyport and chlorinated in a shellfish purification plant. Floating matter of sewage and industrial waste origin have created fire hazards and nuisances under shore installations and contributed to the deterioration of these structures. Floating grease, tars, oils, etc. contribute considerably to the upkeep of commercial and recreational watercraft by fouling bottoms and destroying painted surfaces. There have been occasions where deposits of sewage solids have generated sufficient hydrogen sulfide to destroy the painted surfaces of nearby homes.

Although the records of the Massachusetts Department of Public Health show the quality of water at regulated bathing beaches to meet the Department's standard for safe bathing waters, there are nuisances caused by floating materials of sewage origin being washed onto the beaches. Such nuisances result in many complaints and greatly limit patronage of these beaches because many persons will not bathe in waters known to contain sewage matter. Although repeated analyses show the water qualities to be bacteriologically safe, it should be considered that there is always a menace to the public health when floating sewage debris is present especially when bathing in unsupervised areas is practiced.

Probably the greatest damage to Boston Harbor is the loss of its aesthetic values. The knowledge of the critical pollution of the harbor has greatly reduced the recreational value of the waters and the desirability of waterfront property for homesites. What is the most valuable water resource in the area by far has been for years the public cesspool of the communities which could have benefited most from its use.

The Weymouth Back River is seriously polluted the last mile and a half of its length by untreated wool scouring wastes discharged into it in East Weymouth. Those wastes have a pollutional effect similar in strength to the domestic sewage from approximately 10,000 persons and the water quality downstream from this wool scouring plant is unsuitable for any legitimate use. Nuisance conditions exist during periods of low flow and warm temperatures.

The Mill River, a tributary to the Weymouth Back, receives minor damage from pollution. The South Shore Hospital discharges a small amount of pollution in the form of well-purified effluent from its sewage treatment plant. A commercial laundry on the Mill River also discharges treatment plant effluent but the amount of purification is not adequate to prevent a local nuisance during periods of low flow in the stream.

The only damage to the Weymouth Fore River occurs at a dairy in Weymouth. This plant operates inadequate cesspools which overflow and create local nuisance conditions. The amount of pollution from the Homestead School in Weymouth is insufficient to result in significant damage to the Weymouth Fore River, nor is there significant damage to the Cochato River in Braintree from sewage effluent from the Norfolk County Hospital.

In the town of Hull, the Weir River, as it passes along the town, is damaged by sewage discharged into it from a number of municipal sewers. The river is tidal at these points and the dilution sufficient to prevent gross conditions of pollution. There is a serious menace to the public health, however, particularly to those who may bathe in or otherwise make use of these sewage-polluted waters. Important clam flats have been closed by pollution. There is also a damage to the aesthetic value of these waters from sewage pollution. A large number of persons own summer residences in Hull and across the peninsula from the Weir River is famous Nantasket Beach. A fair proportion of Hull's economy is based on vacationists and the recreation industry. It is not commensurate with Hull's welfare to permit the pollution of waters potentially useful for recreation or so close to high concentrations of bathers and other recreationists.

The water resources serving the Boston metropolitan area are limited because they must serve a large population. This is particularly true of the fresh water resources which are small and where even minor pollution can result in serious damage to the aesthetic value of the streams and a menace to the public health. Because the population of the area is high and the amount of pollution discharged is large, the damages that result are serious.

Pollution Prevention Measures in Effect

Eight of the sources of pollution in the Boston Harbor Subbasin have treatment facilities in operation and all are adequate except two.

In January 1952, the first big step in the abatement of pollution of Boston Harbor was taken when the Nut Island primary treatment and chlorination plant to serve the South Metropolitan Sewerage District was placed in operation. This plant treats the sewage from more than 640,000 persons and industrial wastes from hundreds of manufacturing plants. The population equivalent of these combined wastes is about 1,032,000 persons. After primary treatment for removal of floating and settleable solids, these wastes are reduced in strength to approximately 516,000 persons and the effluent, after chlorination, is discharged into Quincy Bay. The operation of this plant will greatly reduce the bacteriological pollution of Boston Harbor and should eliminate nuisances and undesirable aesthetic conditions caused by sewage matters washed or blown onto nearby shores.

The Homestead School, Boston School for the Deaf, Norfolk County Hospital and the South Shore Hospital all are served by satisfactory secondary sewage treatment plants. These four plants treat sewage from a total of about 800 persons and effectively reduce the pollution to the population equivalent of sewage from only 40 persons.

A large detergent manufacturing plant in Quincy operates a waste treatment plant that, by flotation, effectively removes materials which once caused nuisances and unsightly conditions when discharged into Weymouth Fore River. Two other industrial waste treatment facilities in operation are not satisfactory. The cesspools operated by a dairy and a secondary waste treatment plant, both in Weymouth, do not satisfactorily treat or dispose of the wastes for which they are designed.

The municipal sewage from the North Metropolitan Sewerage District, the Boston Main Drainage System and the town of Hull is discharged into Boston Harbor without treatment as are the wool scouring wastes from the plant in East Weymouth into the Weymouth Back River.

Pollution Prevention Measures Required

There are five pollution control measures needed to be constructed in the Boston Harbor Sub-basin, one of which will serve two present sources of pollution. The largest project by far is the construction of tunnels, headworks, pumping stations and treatment works to serve the combined wastes from the North Metropolitan Sewerage District and the Boston Main Drainage System. While this report has been in preparation, the General Court authorized the above pollution abatement of Boston Harbor and appropriated $50,000,000 for its cost. Some of those works are already under construction, contracts for others have been let and plans for still others are in preparation. Briefly the plans call for conveying sewage from the North Metropolitan Sewerage District and the Boston Main Drainage System to a primary treatment plant to be located on Deer Island. After removal of floating and settleable materials, the sewage is to be chlorinated and discharged into Massachusetts Bay on the outgoing tide. When all of the proposed sewers, tunnels, treatment works, etc. have been placed in operation, the sewage overflows now occurring in the Mystic and Charles River Basins will be eliminated for the most part, the bacteriological pollution of Boston Harbor will be greatly reduced, nuisances at bathing beaches and potential health hazards from floating sewage solids will be eliminated, shellfish areas can be reopened, bathing beach patronage will increase and new beach developments will be feasible, boat maintenance will be reduced and the general health and welfare of the metropolitan area will be benefited.

The town of Hull needs to construct the necessary intercepting sewers, ocean outfall sewer and other works that may be necessary before discharge of municipal wastes a safe distance offshore. When this construction has been completed, the residents in the town can participate in the benefits ascribed to Boston Harbor as a whole. The status of action to provide this needed construction is inactive.

The dairy in Weymouth needs to construct additional milk waste treatment facilities or to make provisions for connection to the municipal system to alleviate a local nuisance. Additions are needed to the existing secondary waste treatment facilities of the laundry in Weymouth to control pollution of the Mill River. The wool scouring plant in Weymouth requires a new waste treatment plant or should connect plant sewers to the municipal sewage system, whichever is shown to be most reasonable and workable. The laundry and the dairy have been requested to take appropriate action by the State health department. The project needed for the wool scouring plant is inactive pending the development of a suitable wool scouring waste treatment method or extension of municipal sewers to make possible a connection with plant sewers.

It is estimated that the cost of the above municipal sewage treatment projects, based on 1952 construction price levels, will be approximately $65,400,000, including the South Metropolitan Sewerage District. There are nearly two million persons residing in the cities and towns to be served by these projects and this indicates a per capita construction cost of about $32.70. However, based on modern methods of financing municipal projects, the cost per capita over a period of 30 years would be approximately $1.45 per year, or roughly the average factory worker's wages for only one hour. Actually, the cost to the individual will be considerably less than shown as industry, which contributes substantially to the pollutional load, will be assessed for these projects in proportion to the value of real property held. Also, as more communities join the metropolitan sewerage systems, the costs will be correspondingly lowered.

The cost of the industrial waste pollution control projects will depend on the final plans approved by the State Department of Public Health. Industrial waste treatment is a production cost which can almost always be borne without financial hardship.

When considered in relation to the very high value of the water resources of the Boston Harbor Sub-basin and the many benefits to be derived therefrom, the cost of the needed pollution control projects is very low.

Table A7
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
Boston Harbor Sub-basin

Source of Pollution and Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Watercourse	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
Boston Harbor							
North M.D.C. System	712,980	1,620,000	Ocean outfall	U	1,620,000	New Plant	Preliminary plans approved
Boston Main Drainage System	453,000	545,800	Ocean outfall	U	545,800	New Plant 4/	Preliminary plans approved
Quincy Bay							
Quincy (C) --Detergent Mfg.	Chemical	N	Secondary (equivalent)	S	10,700	None	
South M.D.C. System	640,890	1,032,000	Primary, Chlorination, Ocean outfall	S	516,000	None	
Weymouth Fore River							
Weymouth (T) --Homestead School	300	300	Secondary	S	30	None	
--Dairy	Dairy	N	Cesspools	U	100	Additions or Conn. to M.S.	Action requested
Cochato River							
Randolph (T) --Boston School for the Deaf	200	200	Secondary	S	(Ground water) 0	None	

1/ C - City; T - Town.

2/ P.E. - Population equivalent in terms of biochemical oxygen demand. N - Undetermined

3/ S - Satisfactory; U - Unsatisfactory.

4/ North M.D.C. and Boston Main Drainage to same plant.

Table A7 (Continued)
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
Boston Harbor Sub-basin

Source of Pollution and Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Watercourse	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
Cochato River(Cont.)							
Braintree (T) --Norfolk County Hospital	145	145	Secondary	S	7	None	
Weymouth Back River							
Weymouth (T) --Wool Scouring	Wool Scouring	10,000	None		10,000	New plant or Conn. to M.S.	Inactive
Mill River							
Weymouth (T) --South Shore Hosp.	150	150	Secondary	S	5	None	
--Laundry	Laundry	N	Secondary	U	40	Additions	Action requested
Weir River							
Hull (T)	2,170	2,170	None		2,170	Pretreatment; Ocean Outfall	Inactive

1/ C - City; T - Town.
2/ P.E. - Population equivalent in terms of biochemical oxygen demand. N - Undetermined.
3/ S - Satisfactory; U - Unsatisfactory.

Section .8

THE NORTH RIVER SUB-BASIN

General Description

The main stem of the North River is formed in the town of Hanover by the confluence of Drinkwater River and French Stream. Between Factory Pond and Forge Pond, the main stem is called Drinkwater River, below Forge Pond for about three miles the name is Indian Head River and for the remaining nine miles the river assumes its principal designation of the North River. The North River Sub-basin drains an area of about 70 square miles, including parts of the towns of Weymouth, Rockland, Abington, Hanover, Hanson, Norwell, Marshfield, Pembroke and Scituate.

The watershed lies in a coastal lowland that contains numerous small lakes and ponds, much swampland and many low hills, none of which rise above an elevation of 200 feet. The principal geologic feature is the granite bedrock formation which outcrops frequently. About 60 percent of the area is covered by woodland of relatively little commercial significance but considerable scenic value. Approximately one-fourth of the basin is in farms of which a little more than 25 percent is in cleared land. Lakes, ponds and marshes account for about 10 percent of the area and the remaining five percent is taken up for roads, dwellings and other urban developments.

The 1950 population residing within the sub-basin was estimated to be 19,200. Two urban towns are partly in the basin, Rockland and Abington, and these account for one-third of the sub-basin's total population. There has been a substantial population increase of about 20 percent since 1940 and this is largely due to an influx of residents from the Boston metropolitan area.

Manufacturing within the sub-basin is on a small scale but it nevertheless provides the largest source of employment and income. In addition to manufacturing within the area, a large proportion of the residents are employed in the nearby industrial cities of Metropolitan Boston. There are an estimated 40 manufacturing plants in the North River Sub-basin and these employed an average total of 2,200 persons in 1947, whose wages and salaries were approximately $5,250,000. The value added to products by manufacture in 1947, the last year for which figures are available, was about $8,925,000.

Farming is on a small scale and largely engaged in dairying and truck gardening. The income from the sale of farm products in 1945 was an estimated $2,000,000. Recreation accounts for an unknown but significant income in the sub-basin which is a part of a popular vacation area. The service and professional groups also account for an appreciable share of the total income which, on a per capita basis, is estimated to be near the average of $1,417 for the Commonwealth as a whole.

Uses of the Water Resources

Public water supply is the highest water use and more than 75,000 persons are served by surface water resources in the North River Sub-basin. Other important water uses are for industrial water supply, recreational bathing, game fishing, livestock watering and transportation of wastes.

The use of the water resources for recreational purposes is becoming increasingly important. The sub-basin contains a number of excellent fresh water ponds, which combined with the streams and other scenic features, makes the area very popular for day-use bathing, summer residence and other vacation and recreational use. These same features appear to be largely responsible for the increased permanent suburban developments that have taken place in recent years.

The water resources of the North River Sub-basin are probably the most important natural resource of the area.

Pollution Contributed to the Water Resources

Pollution of the water resources of the North River Sub-basin is confined to the small tributaries of the main stem. There are eight sources of pollution, all but one having some form of treatment facility in use.

French Stream is most seriously polluted from four separate sources. At its very beginning the stream receives the satisfactory effluent from the Weymouth Naval Air Station sewage treatment plant which serves an undetermined number of persons. In North Abington, French Streams receives its first serious pollution from the unsatisfactory effluent of the secondary sewage treatment plant serving about 750 persons in North Abington and from the unsatisfactory effluent of a septic tank used by an ice cream manufacturing plant. The town of Rockland discharges satisfactory effluent from the high school treatment plant but contributes most to the pollution of French Stream by discharging into it the untreated sewage from about 400 persons residing in the thickly settled portion of the town.

Indian Head Brook in Hanson receives minor pollution from secondary sewage effluent of the Plymouth County Hospital. An unnamed brook receives serious pollution from the untreated sewage of Rockland town and the effluent of a secondary sewage treatment facility serving Jefferson School. Herring Brook in Hanover also receives only minor pollution from the secondary effluent of the treatment plant operated by the St. Coletta School-by-the-Sea.

Pudding Brook in Pembroke, a tributary of Herring Brook, is polluted by the inadequately treated sanitary sewage from employees of a box manufacturing plant. The pollution is largely bacteriological, although a local nuisance may result during periods of low flow and warm temperatures.

Although the only serious pollution occurs in French Stream, Pudding Brook and the unnamed brook in Rockland, the problem should not be considered lightly by the residents of an area that is frequented by vacationists, recreationists and children.

Damages to Water Resources from Pollution

Damages from pollution in the North River Sub-basin have been confined to French Stream, Pudding Brook and the unnamed brook in Rockland. The pollution entering Indian Head Brook and Herring Brook is minor and the water quality in these streams is suitable for all purposes except drinking before disinfection. There are no effects from pollution on the main stem below Herring Brook in Hanover and the water quality from this point to the mouth and in the unpolluted tributaries, is suitable for all uses except public water supply without disinfection.

Damages are most extensive to the water qualities in French Stream, in the unnamed brook in Rockland and downstream on the Drinkwater and Indian Head Rivers. From North Abington to Forge Pond, a distance of about three miles, French Stream is seriously polluted by inadequately treated municipal sewage and milk plant wastes in North Abington and from untreated sewage from private outlets in Rockland. For about a mile, French Stream is in nuisance condition and for the next two miles the water quality is suitable only to carry away these wastes without nuisance. At Forge Pond, French Stream is joined by Drinkwater River and in passing through Forge and Factory Ponds the stream recovers somewhat and becomes suitable for some higher uses. To the confluence of Indian Head River and Herring Brook, however, the water quality is not suitable for public water supply, recreational use except boating, for some industrial processes without treatment and is not always of suitable aesthetic quality. Below Herring Brook, the main stem recovers from almost all effects of upstream pollution.

Pudding Brook is polluted by sanitary sewage from employees of a box factory in Pembroke. Downstream from this plant to its confluence with Herring Brook, Pudding Brook is unsuitable for drinking purposes without filtration and disinfection, recreational uses, and may not always be of satisfactory aesthetic quality. During periods of low flow and high temperature, nuisance conditions may exist near the factory.

Pollution Prevention Measures in Effect

All of the sources of pollution in the North River Sub-basin have treatment facilities in operation except Rockland which discharges untreated municipal sewage. Four of the seven treatment facilities are satisfactory in design and operation while three are inadequate in these respects.

The Weymouth Naval Air Base, Plymouth County Hospital, Jefferson School and St. Coletta School-by-the-Sea all have adequate sewage treatment works in operation. These four sewage treatment plants treat the domestic wastes from more than 1,000 persons and reduce the pollutional load to a population equivalent of less than 100 persons.

North Abington operates an inadequately designed and operated municipal sewage treatment plant that serves about 750 persons. Also in North Abington an ice cream manufacturing plant operates a septic tank for the treatment of milk wastes that produces an unsatisfactory degree of purification. The box factory in Pembroke has an inadequate septic tank which no longer operates for the treatment of employee sanitary sewage. These three inadequate treatment facilities treat wastes having a population equivalent of more than 1,100 persons which are reduced in pollutional load by less than 40 percent.

Pollution Prevention Measures Required

Four pollution control construction projects are needed in the North River Sub-basin. The town of Rockland needs to construct sewers and a new sewage treatment plant to serve the thickly settled portion of the town. The town of Abington will require replacement of the existing inadequate plant now serving North Abington and to construct sewers and adequate treatment works to serve all of the thickly-settled portions of town. Abington has final plans for its project approved by the Massachusetts Department of Public Health while Rockland has taken no action to construct its required sewage treatment plant.

The ice cream plant in North Abington needs to replace its septic tank with a new milk waste treatment plant and has been requested by the State health department to take this action. The box factory in Pembroke needs to renovate the existing septic tank and to add satisfactory sub-surface disposal facilities for the treatment of employee sewage. This needed project is inactive at present.

The comprehensive pollution control projects required in the North River Sub-basin are not large in size and cost but are large in importance due to the relatively high value of the scenic and recreational value of the water resources. Some of the larger cities and towns nearby are already looking to the North River system for additional public water supply. It behooves the residents of this area to take whatever steps are necessary to conserve this most important natural resource in the best interests of the majority.

The cost of the two municipal sewage treatment plants needed by Rockland and North Abington is estimated to be about $500,000, based on 1952 construction cost levels and exclusive of sewers which may be needed. There are approximately 16,100 persons residing in these two municipalities and this indicates a per capita construction cost for sewage treatment works of about $31.50. However, based on modern methods of financing municipal construction projects, the cost to the individual over a 30-year period would be only about $1.35 per year or less than three cents per week.

This is a small price to pay to protect the health and welfare of the residents and to conserve a valuable natural resource for their use and enjoyment.

Table A8
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
North River Sub-basin

Source of Pollution and Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Watercourse	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
French Stream							
Weymouth (T)							
--Weymouth Naval Air Station	N	N	Secondary	S	N	None	
Rockland (T) 5/	400	400	None		400	Sewerage; New plant	Inactive
--High School	500	170	Secondary	S	10	None	
Abington (T)							
--Ice Cream Mfg.	Ice cream	N	Primary	U	280	Replacement	Action reqst'd
--North Abington (V)	750	750	Secondary	U	375	Replacement, Sewerage	Final plans approved
Indian Head Brook							
Hanson (T)							
--Plymouth County Hosp.	155	155	Secondary	S	8	None	
Unnamed Brook							
Rockland (T) 5/	600	600	None		600	Sewerage, New plant	Inactive
--Jefferson School	230	230	Secondary	S	23	None	

1/ C - City; T - Town; V - Village
2/ P.E. - Population equivalent in terms of biochemical oxygen demand. N - Undetermined.
3/ S - Satisfactory; U - Unsatisfactory.
5/ Rockland discharges private sewers to two streams in thickly settled portion but counted one source of pollution requiring one project.

Table A8 (Cont.)
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
North River Sub-basin

Source of Pollution and Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Watercourse	Waste Treatment Requirements	Current Status of required Projects
			Kind	Status 3/			
Pudding Brook Pembroke (T) --Wooden Boxes 4/	Sanitary Sewage	25	Primary	U	10	Additions	Inactive
Herring Brook Hanover (T) --St. Coletta School-by-the-Sea	85	85	Secondary	S	10	None	

1/ C - City; T - Town; V - Village
2/ P.E. - Population equivalent in terms of biochemical oxygen demand. N - Undetermined.
3/ S - Satisfactory; U - Unsatisfactory.
4/ Not counted as a source of pollution but project for employee sewage required under State health department policy.

Section .9

THE SOUTH SHORE SUB-BASIN

General Description

The South Shore Sub-basin is comprised of all the area south of the Norfolk-Plymouth County line and north of the Barnstable-Plymouth County line draining into the Atlantic Ocean with the exception of the North River watershed which is treated separately in this report. The total drainage area included in this arbitrary sub-basin is approximately 165 square miles. The principal streams included are the James, Jones and Eel Rivers and Satuit Brook. The watershed drains all or parts of the towns of Plymouth, Kingston, Plympton, Halifax, Pembroke, Scituate, Marshfield, Duxbury, Carver, Hingham and Cohasset.

To the north of Plymouth the terrain is coastal lowland containing many lakes, ponds and marshes interspersed with low, rolling hills. In Plymouth the terrain becomes more rugged and there are many low hills and frequent ponds. Granite underlies most of the area near the surface and outcrops frequently. Almost 60 percent of the area is covered with woodland of great scenic but little commercial value otherwise. Included in the sub-basin is a part of the Myles Standish State Forest. About one-fourth of the area is in farms of which less than 25 percent is in cleared land. Lakes, ponds and marshes cover some 10 percent of the area and roads, dwellings, etc. account for the remaining five percent of the area.

The 1950 population residing within the South Shore Sub-basin was an estimated 32,800, an increase of some 20 percent since 1940. Plymouth is the largest town in the sub-basin and in 1950 had a reported population of 13,608.

Manufacturing activities are not on a large scale and the area is far more rural than industrialized. Nevertheless, manufacturing provides the largest source of income and employment and there are an estimated 100 plants engaged in some type of manufacturing in the sub-basin. These plants employed an average total of 5,000 employees during 1947, the last year for which figures are available and their salaries and wages totaled $12,200,000. Manufacture in that year added a total value to products of about $20,800,000.

Agriculture, largely dairying and specialty farming, added a substantial $6,200,000 to the sub-basin income, principally from the sale of livestock and livestock products. The watershed contains important recreational areas and this activity probably brings several million dollars income into the sub-basin each year. The service and professional groups add appreciably to the total income as do commercial fishing and shellfishing activities.

Uses of the Water Resources

There are varied and important uses made of the water resources of the South Shore Sub-basin. Public water supply is the highest use made and other important purposes are for recreational bathing, game fishing, industrial water supply, livestock watering, commercial fishing, shellfish propagation, cranberry growing, boating and transportation of sewage and industrial wastes.

The sub-basin enjoys extensive salt and fresh water resources. Along the coast there are excellent beaches and almost the entire coastline has been developed for recreation. Inland there are numerous lakes and ponds that have been, or are being, extensively developed for recreation purposes.

The water resources of the South Shore Sub-basin are probably the most valuable natural resourc of the area.

Pollution Contributed to the Water Resources

There are 11 separate sources of pollution discharged into five streams and three coastal areas. Six sources of pollution are caused by the discharge of domestic or municipal sewage, four by industrial wastes and one by sanitary sewage from a manufacturing plant.

In the town of Cohasset private sewers serving an estimated 850 persons discharge into the James River. In Scituate private sewers estimated to serve 200 persons discharge into Satuit Brook and still others serving some 400 persons discharge into Scituate Harbor. Private sewers in Marshfield are responsible for pollution of the shallow coastal waters fronting the town by sewage from about 200 persons. Halls Brook in Kingston is polluted by private sewers discharging domestic wastes from some 200 persons. None of these communities have municipal sewerage systems. Plymouth, which does have a municipal system, discharges its municipal sewage into the shallow coastal waters fronting the town. The Plymouth sewers have a reported connected population of 11,000 persons.

In addition to pollution from private sewers, Satuit Brook receives minor pollution from treated laundry wastes. In Kingston the Jones River is polluted by untreated industrial wastes from a woolen mill and a commercial laundry which have a pollutional load equivalent to the domestic sewage from about 2,650 persons. Smelt Brook, a tributary to the Jones River in Kingston, receives the acid wastes from rivet manufacture.

Hall's Brook is also polluted by employee sewage of a tool manufacturing plant in addition to the private sewers in Kingston. A large cordage manufacturing plant in Plymouth discharges the sanitary sewage from about 1,000 employees into the nearby shallow coastal waters.

The total pollutional load discharged to water resources in the South Shore Sub-basin is equivalent to the domestic sewage from approximately 16,500 persons.

Damages to Water Resources from Pollution

Pollution from private sewers in Cohasset enters the James River and is transported into Cohasset Cove and Cohasset Harbor. This pollution constitutes a menace to the public health, creates local nuisance conditions, impairs game fishing in the lower river and renders the waters in the cove and harbor unsuitable for recreational bathing. Cohasset Harbor is an important recreational asset and its pollution, together with the indiscriminate discharge of sewage into nearby streams and storm drains which create health hazards and nuisance conditions, is not commensurate with the potentialities of this very pretty New England town as a residential suburb or for summer vacation and recreation development.

In the town of Scituate, Satuit Brook and Scituate Harbor are polluted by domestic sewage from private sewers serving 600 persons. As in Cohasset, a health menace exists, local nuisances are created and Satuit Brook serves no useful purpose. The waters of Scituate Harbor are not suitable for recreational bathing. Scituate, too, is a very pretty town with excellent potentialities for more growth as a residential suburb, summer vacation resort, and recreation area. Although excellent beaches exist outside the harbor, the pollution of the important water resources in the thickly settled portion of Scituate represents a real loss to the community.

Marshfield discharges domestic sewage from about 200 persons into the shallow waters of the Atlantic Ocean fronting the town and into Green Harbor River. What has been written above for Cohasset and Scituate applies also to the town of Marshfield.

The Jones River and two of its small tributaries, Halls Brook and Smelt Brook, are seriously damaged by pollution entering them in the built-up part of the town of Kingston. Untreated sewage and wastes from a woolen mill, laundry and rivet plant damage the water quality of these three streams from the sources of pollution to the mouths for all uses except conveying these wastes without nuisance. Fish kills have been reported and most important, the existence of these sources of sewage pollution constitute a potential hazard to the public health.

In Plymouth the shallow waters of Plymouth Harbor fronting the town are damaged by pollution from sewage discharged at several points from municipal sewers serving 11,000 persons and by sanitary sewage from approximately 1,000 employees of a cordage plant. This amount of pollution has resulted in closing of the harbor for the taking of shellfish and exists as a potential menace to the health of those bathing in or making other recreational use of these waters. Plymouth Harbor is an important asset to a recreation community that is annually visited by vacationists from all over the Nation. The continued pollution of the harbor is not consistent with the best interests in the health and welfare of the town.

Pollution Prevention Measures in Effect

Although there are 12 sources of pollution existing in the South Shore Sub-basin, there has been only one treatment facility placed in operation. A laundry in Scituate has constructed a secondary laundry waste treatment plant which effectively reduces an otherwise objectionable waste to a negligible source of pollution.

All other sources of pollution, mostly sewage, are discharged directly into receiving waters without treatment.

Pollution Prevention Measures Required

All of the sources of pollution in the South Shore Sub-basin, save the laundry in Scituate, require a construction project to control pollution of the area's valuable water resources.

Cohasset, Marshfield, Kingston and Plymouth all require the construction of plants providing preliminary or primary treatment with final disposal in the ocean from a satisfactory outfall sewer. Cohasset, Marshfield and Kingston also require construction of municipal sewerage systems to serve the thickly settled portions of those towns. Kingston may be able to solve its pollution problems by requiring adequate subsurface disposal of domestic sewage at each of the sources of pollution. Cohasset and Plymouth have preliminary plans for their projects approved by the Massachusetts Department of Public Health, but Marshfield and Kingston have taken no action.

The town of Scituate will require two projects, one a secondary sewage treatment plant to serve the persons living in Scituate Center and the other a primary treatment plant and ocean outfall sewer to serve the portion of the town called Scituate. These projects both require the construction of municipal sewers. Preliminary plans for the Scituate project have been approved by the State health department but the project for Scituate Center is inactive at present.

The woolen mill, laundry and rivet plant in Kingston all require new waste treatment projects. The woolen mill has been requested by the State health department to take action to provide needed treatment while the status of action on the laundry and rivet plant needs is inactive. Also in Kingston a hand tool manufacturing plant needs to provide subsurface disposal for employee sewage and this project is inactive.

The large cordage plant in Plymouth will be required to connect plant sewers to the municipal sewerage system for final disposal of employee sewage in the proposed town treatment works and ocean outfall sewer. No action has been taken to make this connection.

It is estimated that the cost of the above municipal sewage projects, based on 1952 construction cost levels, would be approximately $3,300,000. The cost of these projects is high because each requires the construction of a formal municipal system or a long outfall sewer. There are more than 30,000 persons residing in the towns requiring these projects and this indicates a per capita construction cost of about $110. However, based on modern methods of financing municipal construction projects, the cost to the average individual over a period of 30 years would only be about $4.80 per year.

These construction costs should not be considered as lost income but rather as an investment in the improvement of the properties to be served. The value of real estate to be served by these required sewerage and sewage disposal projects will be increased by these improvements far beyond their cost. Further, treatment must be provided for the existing sewage pollution and municipal projects are much more satisfactory and less expensive than treatment undertaken by the individual householder.

At whatever reasonable cost, these sewage and industrial waste treatment and disposal projects are needed to protect the health and welfare of residents and visitors and to permit the full residential and recreational development of these five South Shore towns.

Table A9
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
South Shore Sub-basin

Source of Pollution & Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Watercourse	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
James River							
Cohasset (T)	Private Sewers	850	None		850	New Plant	Preliminary Plans Approved
Satuit Brook							
Scituate (T)							
--Scituate Center	Private Sewers	200	None		200	New Plant	Inactive
--Laundry	Laundry	(N)	Secondary	S	Negligible	None	
Scituate Harbor							
Scituate (T)							
--Scituate (V)	Private Sewers	400	None		400	New Plant	Preliminary Plans Approved
Atlantic Ocean							
Marshfield (T)	Private Sewers	200	None		200	New Plant	Inactive
Jones River							
Kingston (T)							
--Woolen Mill	Dye and finish	2,550	None		2,550	New Plant	Action Requested
--Laundry	Laundry	100	None		100	New Plant	Inactive

1/ C - City; T - Town; V - Village. 2/ P.E. - Population equivalent in terms of biochemical oxygen demand
3/ S - Satisfactory; U - Unsatisfactory.

Table A9
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
South Shore Sub-basin

Source of Pollution & Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated	Treatment		P.E to Water	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
Halls Brook							
Kingston (T)	Private Sewers	200	None		200	New Plant or Individual Treatment	Inactive
--Hand Tools 4/	Sanitary Sewage	10	None		10	Subsurface Disposal	Inactive
Smelt Brook							
Kingston (T) --Rivets	Acid	Does not apply	None		Does not apply	New Plant	Inactive
Plymouth Harbor							
Plymouth (T)	11,000	11,000	None		11,000	New Plant	Prelim. Plans Approved
Cordage Mfg.	Sanitary Sewage	1,040	None		1,040	Connection to Municipal System	Inactive

1/ C - City; T - Town; V - Village
2/ P.E. - Population equivalent in terms of biochemical oxygen demand.
3/ S - Satisfactory; U - Unsatisfactory
4/ Not counted as source of pollution but project for employee sewage required under State health department policy.

Section .10

BUZZARDS BAY SUB-BASIN

General Description

The Buzzards Bay Sub-basin has been taken to include all of the watersheds draining into Buzzards Bay excluding those very small streams in Cape Cod which are included in this report as a part of the Cap Cod Sub-basin. The total drainage area included in the Buzzards Bay Sub-basin is 370 square miles, all contained in Plymouth and Bristol Counties and including all or parts of the towns of Acushnet, Dartmouth, Fairhaven, Freetown, Westport, Wareham, Middleborough, Carver, Plymouth, Rochester, Mattapoisett, Marion and all of the city of New Bedford. The principal streams draining into Buzzards Bay are the East Branch Westport River, West Branch Westport River, and the Slocum, Acushnet, Mattapoisett, Weweantic and Wareham (Wankinco and Agawam) Rivers.

The terrain is typically coastal lowland, containing much marshy land to the south, many lakes and ponds to the north and over all low, rolling hills. Granite underlies most of the area and thrusts through the surface in many places. About 70 percent of the sub-basin is covered with woodland of small commercial but considerable scenic value. Less than 10 percent of the area is in farmland and of this less than 40 percent is in cleared land. The extensive marshes and many lakes and ponds cover about 15 percent of the watershed and roads, buildings, and other urban developments account for the remaining five percent of the area.

The 1950 population of the sub-basin was an estimated 159,600 of which the city of New Bedford accounted for over 109,000. New Bedford experienced a small loss in population since 1940 but the sub-basin as a whole gained slightly in population.

New Bedford is an important manufacturing center and is a part of the Fall River-New Bedford standard metropolitan area (containing 40,000 employees or more). There are an estimated 200 manufacturing plants in the sub-basin and in 1947, the last year for which data are available, these plants employed an average of 17,800 persons and paid $42,000,000 in salaries and wages. The value added to products by manufacture in 1947 was more than $73,000,000.

Commercial fishing activities annually produce a multi-million dollar income. Recreation is an important source of employment and income which probably amounts to several million dollars each year. Agriculture is largely in specialty farming and dairying and in 1945 the activities produced an estimated $3,000,000 income. The incomes of the self-employed and those engaged in the service industries add considerably to the total income of the sub-basin.

Uses of the Water Resources

The water resources of the Buzzards Bay Sub-basin are probably its most valuable natural resource. Public water supply is the highest water use and other important uses are for industrial water supply, recreational bathing, commercial fishing, shellfish propagation, livestock watering, cranberry growing, game fishing, navigation and transportation of sewage and industrial wastes.

The sub-basin has extensive salt water resources and appreciable fresh water resources. Almost the entire coastline has been developed for recreation. Inland there are many lakes and ponds that are, or are being, developed for recreation. The sub-basin is part of the Cape Cod-Buzzards Bay recreational area which is one of the most popular and extensively developed centers of recreation of its size in the country.

Pollution Contributed to the Water Resources

There are nine separate discharges of pollution into the Acushnet and Wareham Rivers and into Buzzards Bay. Four sources of pollution are caused by sewage and five by industrial process wastes.

In Wareham a nail manufacturing plant and a commercial laundry discharge untreated acid wastes and laundry wastes into the Wareham River. The laundry wastes are equivalent in pollutional load to the untreated domestic sewage from 340 persons. The acid nail wastes have a different effect on streams and are not measurable in terms of population equivalent.

The Acushnet River is severely polluted although the recent improvements which have been made have alleviated the previously prevailing nuisance conditions. The town of Fairhaven discharges municipal sewage from about 9,000 persons directly into the Acushnet River at several outlets without treatment. On the New Bedford side there are a number of overflowing sewers that contribute substantial pollution to the river. Also in New Bedford, a large brass mill discharges waste oils directly into the Acushnet River. In the town of Acushnet a large golf ball manufacturing plant discharges process wastes having a population equivalent of over 200 persons.

Buzzards Bay receives four separate discharges of pollution. The city of New Bedford discharges the municipal sewage from a connected population of 111,000 into Buzzards Bay through an ocean outfall sewer extending out into the bay. Industrial wastes intercepted by the New Bedford sewers increase the strength of the municipal sewage to a total population equivalent of approximately 412,000 persons. In Mattapoisett, private sewers estimated to serve 400 persons discharge untreated domestic sewage into the shallow coastal waters. The town of Marion contributes minor pollution in the form of effluent from a satisfactorily designed and operated secondary sewage treatment plant. A large tack manufacutring plant in Fairhaven discharges acid wastes into Buzzards Bay after minor treatment that is inadequate.

Scattered throughout the Buzzards Bay area there are a large number of summer residences and camps, many having plumbing systems that discharge to private sewers leading into nearby shallow coastal waters or small streams. Most of these individual sources of pollution are too small and scattered to be counted as separate sources of pollution in this report which has been confined to sources contributed to by 30 persons or more in compacted areas. During the vacation season, the boat population of the small harbors of Buzzards Bay is very high and sewage and refuse from these watercraft contribute substantially to the pollution problem. Taken separately, these small sources of sewage from private sewers and anchored watercraft are minor, but collectively they represent a serious water pollution problem in a highly developed recreation area.

Damages to Water Resources from Pollution

In the lower Wareham River, acid wastes from nail manufacturing, wastes from a commercial laundry and scattered private sewer outlets have damaged the water quality for use in recreational bathing and caused the closing of the area for the taking of shellfish.

The Acushnet River is grossly polluted by sewage and industrial wastes. Throughout the tidal section, there are heavy deposits of organic solids that are a fermenting mass. The water quality in the tidal section is unsuitable for all purposes except navigation and limited industrial purposes and during the warm months nuisance conditions exist.

Sewage from private outlets has caused the closing of parts of Mattapoisett Harbor in Mattapoisett, Clark Cove in New Bedford and Apponagansett Bay in Dartmouth to the taking of shellfish. These and other private sewer outlets in the Buzzards Bay area must also be considered as a menace to the public health of those engaged in the recreational use of the receiving waters and unaware of the existence of sewage pollution.

Pollution Prevention Measures in Effect

The town of Marion operates a secondary sewage treatment plant serving 1,000 persons that effectively reduces the pollutional load by 90 percent before discharge into Buzzards Bay. New Bedford disposes of its municipal sewage into the deeper waters of Buzzards Bay off Clark Point after screening. New Bedford also serves a part of the town of Dartmouth. Sewage disposal is not satisfactory, however, as sewers along the Acushnet River are not all connected to the intercepting sewer leading to the ocean outfall.

A cranberry processing plant in Wareham has recently installed treatment facilities with discharge of effluent to ground water. This facility is operated satisfactorily and since no stream pollution results from its operation, it has not been counted as a source of pollution in this report. A tack manufacturing plant in Fairhaven has a lagoon for treatment of acid and metal wastes but this produces only a minor reduction in pollution and is not a satisfactory method of treating these wastes.

All other sources of pollution in the Buzzards Bay Sub-basin are discharged to the water resources without treatment.

Pollution Prevention Measures Required

There are seven sources of pollution in the Buzzards Bay Sub-basin requiring construction projects for the abatement of water pollution. Four projects are to be required for industrial wastes and three for municipal sewage.

The city of New Bedford needs to construct the necessary connections of all municipal sewers to the intercepting sewers for conveyance to the screen house and disposal through the deep water outfall sewer into Buzzards Bay. This city is actively planning the construction of these connections.

The town of Fairhaven need to construct intercepting sewers and a new primary treatment and chlorination plant with disposal of effluent into the Acushnet River or New Bedford Harbor. The town has preliminary plans for this construction approved by the Massachusetts Department of Public Health.

The town of Mattapoisett needs to construct a municipal sewerage system for the collection of domestic sewage in the thickly settled portion of the town and to construct a new sewage treatment plant before disposal of these wastes into Buzzards Bay. No action is being taken to provide these needed works.

The laundry in Wareham needs to provide a new industrial waste treatment plant to alleviate pollution of the Wareham River but no action on this project has been taken. The tack manufacturing plant in Fairhaven will be required to construct additional treatment facilities or connect to the municipal sewerage system. This project is inactive at present.

The golf ball manufacturing plant in Acushnet needs a new industrial waste treatment plant to abate pollution of the Acushnet River and this plant has been requested to take this action by the State health department. The brass mill in New Bedford needs to connect plant sewers to the municipal sewerage system and has been requested to do so by the State health department.

Although not listed as separate projects, the sources of pollution from private sewers in the Buzzards Bay Sub-basin need to be located and the owners required to provide satisfactory subsurface disposal for these domestic wastes.

Based on 1952 construction cost levels, it is estimated that the construction costs for the projects at New Bedford, Fairhaven and Mattapoisett will be approximately $6.00, $50.00 and $100.00 per capita respectively. However, based on modern methods of financing municipal projects, it is estimated that over a period of 30 years the average costs to the individual in the same order again would be roughly $0.27, $2.20 and $4.40 per year. The cost of construction is higher for Mattapoisett because this community requires a municipal sewerage system as well as a treatment plant. The properties served by these sewerage improvements, however, will be increased in real value far more than the assessment made to cover their cost.

The cost of the industrial waste treatment projects needed cannot be determined until final plans are approved by the Massachusetts Department of Public Health. Industrial waste treatment is a production cost that can usually be borne without undue financial hardship.

The above projects are needed to protect the health and welfare of the residents and visitors of the Buzzards Bay Sub-basin and to permit the fullest practicable use and development of the very valuable water resources. The adoption of the above projects and certain other elements of a comprehensive pollution control program will conserve the water resources for the maximum benefits to the largest number of people.

Table A10

BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION

Buzzards Bay Sub-basin

Source of Pollution & Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Water-course	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
Onset Bay							
Wareham (T) --Cranberry processing	Food	(N)	Secondary	S	0 - (ground water)	None	
Wareham River							
Wareham (T) --Nail Mfg.	Acid	Does not apply	None		Does not apply	None 4/	
--Laundry	Laundry	(N)	None		340	New Plant	Inactive
Buzzards Bay							
Marion (T)	1,000	1,000	Secondary	S	100	None	
Mattapoisett (T)	Private Sewers	400	None		400	New Plant	Inactive
Fairhaven (T) --Tack Mfg.	Acid	Does not apply	Minor	U	Does not apply	Additions	Inactive
New Bedford (C)	111,000	412,000	Ocean Outfall	U	412,000	Additions	Active Planning
--Dartmouth (T)	(Served by New	Bedford)					
Acushnet River							
Acushnet (T) --Golf Ball Mfg.	Caustic Soap	216	None		216	New Plant	Action Requested
Fairhaven (T)	9,000	9,000	None		9,000	New Plant	Prelim.Plans Appr.
New Bedford (C)	N 5/-Municipal Sewage	(Overflowing municipal sewers)			N 5/	(See New Bedford	above) 6/
--Brass Mill	Oil	Does not apply	None		Does not apply	Conn.to Mun.Sys.	Action Requested

1/ C - City; T - Town; V - Village. 2/ P.E.-Population equivalent in terms of biochemical oxygen demand.
3/ S - Satisfactory; U - Unsatisfactory. 4/ Dilution satisfactory method of disposal for the present.
5/ N - Undetermined. 6/ A part of overall project and not counted as separate source of pollution or separate project.

Section .11

THE CAPE COD SUB-BASIN

General Description

The Cape Cod Sub-basin is comprised of all the area south of the Cape Cod Canal plus the watershed of Herring River (Bourne town) and several small brooks which drain south into the canal. The total drainage area included in this sub-basin is 405 square miles, being all of Barnstable County and a very small part of Plymouth County. All of the streams in this sub-basin are very small and the largest, Bass River, has a drainage area of less than 15 square miles.

Cape Cod is a terminal moraine some 30 miles in length. The sand, gravel and other glacial debris is covered with a thin topsoil which supports an extensive scrub growth. The area contains low, rolling hills, very few of which attain an elevation of 200 feet and the cape features many small lakes and ponds. The topsoil and beaches show extensive erosion from the action of winds and waves.

The soil on Cape Cod is not suitable for general farming practices and less than 10 percent is in farms, only one-third of this being in cleared land. Farming is largely devoted to the cultivation of cranberries and this area produces nearly a third of the Nation's entire crop.

The 1950 population of the Cape Cod Sub-basin was an estimated 46,800. Barnstable is the largest town with a reported 1950 population of 10,480. In 1950, Barnstable, Falmouth and Provincetown were classified as urban and these towns account for nearly half the total population of the sub-basin. The area experienced a 25 percent increase in population since 1940.

Recreation provides the largest source of employment and income. Cape Cod has tremendous recreational value in its extensive sandy beaches, lakes, ponds and mild climate. For years the area has been a very popular rendezvous for vacationists and summer residents. The value of Cape Cod as a recreational area is among the highest of areas of similar size in the United States. The income from recreation is not available but probably exceeds $10,000,000 annually and indirectly accounts for several million dollars more.

Agriculture accounted for the second largest income and in 1945, the last year for which figures were available, the value of products sold in the sub-basin was more than $3,600,000, almost all from cranberries, livestock and livestock products.

Manufacturing is on a small scale and in 1947 there were about 40 manufacturing plants on Cape Cod that employed some 600 persons.

In 1947, manufacturing employees earned a total of approximately $1,360,000 and the value added to products by manufacture was an estimated $2,500,000. The professional and service groups and commercial fishing activities account for most of the remainder of the income of the Cape Cod Sub-basin.

Uses of the Water Resources

The Cape Cod Sub-basin has very extensive water resources in its salt water beaches, numerous bays and coves, and inland lakes and ponds. The streams are all quite small but many provide game fishing and other water-use recreational activities.

Public water supply is the highest use made of the water resources. Eight of the 15 towns in the sub-basin have public supplies, one being taken from Long Pond (Falmouth) and seven being derived from gravel packed wells. The most extensive use of the water resources is for all types of water recreation. Other important uses are for industrial water supply, livestock watering, commercial fishing, cranberry growing, shellfish propagation and transportation of sewage and industrial wastes.

The water resources of the Cape Cod Sub-basin are the most important natural resource in the area.

Pollution Contributed to the Water Resources

There are 11 separate sources of pollution discharged directly into the water resources of the Cape Cod Sub-basin. With two exceptions, these wastes are discharged into shallow coastal waters.

In the town of Bourne, Cape Cod Canal receives the unsatisfactorily treated sewage plant effluent from the Sagamore Apartments and the untreated wastes from a fish and cranberry processing plant in Sandwich.

Cape Cod Bay (including Barnstable and Provincetown Harbors) receives pollution from five sources, three from fish processing wastes, one from processing both fish and cranberries in season and the satisfactory sewage effluent from a municipal plant serving 250 persons in Barnstable.

In Wellfleet town, Camp Wellfleet discharges the effluent from an adequate secondary sewage treatment plant serving an undetermined number of persons into the Atlantic Ocean.

Stepping Stone Brook in Chatham is seriously polluted by unsatisfactory effluent from a secondary laundry waste treatment plant. Falmouth Inner Harbor is only slightly polluted by the effluent from the secondary sewage treatment plant serving about 225 persons residing in the Falmouth Housing Project.

Vineyard Sound in Falmouth receives pollution from the ocean outfall sewer serving about 150 persons living in Woods Hole. The ocean outfall discharges into deep water and the pollution resulting is not significant to normal water uses.

There are a large number of summer residences and camps distributed throughout the Cape Cod area and many of these have plumbing systems that discharge to private sewers leading to the shallow coastal waters or to small streams. Most of these individual sources of pollution are too small and dispersed to be counted as separate sources of pollution in this report which has been confined to sources contributed to by 30 persons or more in compacted areas. During the recreation season, the boat population of the small harbors and coves along Cape Cod is very high. Sewage and refuse discarded from these watercraft contribute substantially to the overall water pollution problem. Taken separately, the pollution from individual sewers and anchored watercraft is minor but collectively they represent a serious water pollution problem in a highly developed recreation area.

Damages to Water Resources from Pollution

The sources of pollution in the Cape Cod Sub-basin are not large and damages to the quality of receiving waters have not been too serious for the most part with one exception. The presence of a large number of private sewers discharging into the shallow coastal waters and small streams is a serious potential hazard to the health of those using these waters for recreational purposes and unaware of the existence of these sources of pollution.

Sources of private sewage pollution are also responsible for the closing of shellfish areas in Provincetown Harbor, Lewis Bay, Falmouth Inner Harbor and Little Harbor at Woods Hole.

The cranberry and fish processing plants in Barnstable, Sandwich, Provincetown and Truro create local nuisances during periods of high production by disposing of process wastes into the shallow coastal waters.

Although the damages to the water resources of the Cape Cod area are not extensive, they should not be taken lightly by the residents. No sources of pollution creating a menace to the public health or a public nuisance should be permitted to exist in such a valuable and highly patronized recreation area.

Pollution Control Measures in Effect

Within recent years there has been an appreciable amount of pollution abatement effected in the Cape Cod Sub-basin. All of the sources of pollution except the five cranberry and fish processing plants have treatment facilities in operation and all of those except one provide adequate treatment.

In Bourne town, the Sagamore Apartments are served by a secondary sewage treatment plant that is not adequate for the 125 persons being served. Camp Wellfleet in Wellfleet town, a military establishment, is adequately served by a secondary sewage treatment plant. The Falmouth Housing Project operates a satisfactory secondary treatment plant for the sewage from about 225 residents. The village of Woods Hole in Falmouth town is adequately served by an ocean outfall sewer which satisfactorily disposes of sewage from about 150 persons.

In Chatham, a laundry has provided an unsatisfactory secondary waste treatment plant, the effluent from which causes a considerable amount of pollution.

In addition to the sources of pollution served by treatment facilities, there are five other sewage or industrial waste treatment projects that have been completed in the Cape Cod Sub-basin. Camp Edwards, a military base, has a secondary sewage treatment plant serving a large number of persons, the effluent being discharged to ground water. This is also the situation at Hyannis in Barnstable town where 3,000 persons are served by a secondary sewage treatment plant, the effluent from which enters the ground water. Provincetown has no municipal sewers or sewage treatment plant but this community recently completed a project requiring individual treatment at private outlets that served an estimated total of 1,000 persons.

A laundry in West Yarmouth and another in Falmouth have constructed satisfactory secondary laundry waste treatment plants and the effluent is carried off into the ground water. None of the communities or the two laundries having treatment facilities discharging effluents to ground waters are considered as sources of stream pollution in this report, nor have they been counted as such.

Pollution Prevention Measures Required

There are six sources of pollution in the Cape Cod Sub-basin requiring construction of plants for the abatement of water pollution. Five are needed for the treatment of cranberry and/or fish processing wastes and one for the treatment of domestic sewage.

The fish and cranberry processing plants in Sandwich and Barnstable and the fish processing plants in Provincetown (2) and Truro all need to construct some type of treatment works to prevent local nuisance conditions in the receiving shallow coastal waters.

In Bourne, the sewage treatment plant of the Sagamore Apartments requires additions to existing units to produce a satisfactory effluent before disposal in the Cape Cod Canal.

Although not listed as separate sources of pollution requiring separate projects, all of the private sewers in the Cape Cod Sub-basin discharging untreated sewage need to be located and the owners responsible required to provide satisfactory subsurface disposal for these domestic wastes.

The cost of the Sagamore Apartment additions to the existing sewage treatment plant will probably be less than $10,000.

The final plans approved for the industrial waste treatment projects will determine the cost of these projects. Industrial waste treatment is properly chargeable to production costs and can usually be borne without undue financial hardship.

The above projects are needed to protect the health and welfare of the residents and visitors to the Cape Cod area, to eliminate local nuisance conditions and to permit the fullest practicable use and enjoyment of the very valuable water resources. The adoption of the above projects and certain other elements of a comprehensive water pollution control program will conserve the water resources for the maximum benefits to the largest number of people.

Table A11
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
Cape Cod Sub-basin

Source of Pollution and Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Water-course	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
Cape Cod Canal							
Bourne (T)							
--Sagamore Apartments	125	125	Secondary	U	50	Additions	Active planning
Sandwich (T)							
--Fish & Cranberry Processing	Food	(N)	None		(N)	New plant	Inactive
Cape Cod Bay							
Barnstable (T)	250	250	Secondary	S	25	None	
--Fish & Cranberry Processing	Food	(N)	None		(N)	New plant	Inactive
Provincetown (T)	Private sewers	1,000	Cesspools	S	0 (Ground water)	None	
--Fish Processing	Food	(N)	None		(N)	New plant	Inactive
--Fish Processing	Food	(N)	None		(N)	New plant	Inactive
Truro (T)							
--Fish Processing	Food	(N)	None		(N)	New plant	Inactive
Atlantic Ocean							
Wellfleet (T)							
--Camp Wellfleet	N	N	Secondary	S	N	None	
Stepping Stone Brook							
Chatham (T)							
--Laundry	Laundry	(N)	Secondary	U	N	Additions	Active planning

1/ T - Town; V - Village.
2/ P.E. - Population equivalent in terms of biochemical oxygen demand; N - Undetermined.
3/ S - Satisfactory; U - Unsatisfactory.

Table A11 (Continued)
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
Cape Cod Sub-basin

Source of Pollution and Receiving Watercourse 1/	Number Sewered or Type of Wastes	P.E. 2/ Untreated Wastes	Treatment		P.E. 2/ to Water course	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 3/			
Lewis Bay							
Yarmouth (T)							
--W. Yarmouth (V)	Laundry	(N)	Secondary	S	0 (Ground water)	None	
Vineyard Sound							
Barnstable (T)							
--Hyannis (V)	3,000	3,000	Secondary	S	0 (Ground water)	None	
Falmouth (T)							
--Laundry	Laundry	(N)	Secondary	S	0 (Ground water)	None	
Falmouth Inner Harbor							
Falmouth (T)							
--Falmouth Housing Proj.	225	225	Secondary	S	25	None	
Vineyard Sound							
Falmouth (T)							
--Camp Edwards	(N)	(N)	Secondary	S	0 (Ground water)	None	
--Woods Hole (V)	150	150	Ocean outfall	S	150	None	

1/ T - Town; V - Village.
2/ P.E. - Population equivalent in terms of biochemical oxygen demand; N - Undetermined.
3/ S - Satisfactory.

Section .12

THE ISLANDS SUB-BASIN

General Description

The Islands Sub-basin is comprised of the Elizabeth Islands and Marthas Vineyard, which constitute all of Dukes County and the island of Nantucket which is Nantucket County. The total watershed area is 152 square miles and all of the streams are very small, the largest being Mill Brook on Marthas Vineyard which has a drainage area of less than ten square miles.

The islands are continuations of the Cape Cod terminal moraine. These glacial deposits of sand, gravel and rocks are covered with a thin topsoil not conducive to good farming but supporting a considerable scrub growth. The islands contain many low hills interspersed with swamps and ponds. The area has extensive resources in its long sandy beaches, sheltered coves and harbors, and inland lakes and ponds.

The 1950 population of the Islands Sub-basin was reported to be 9,117. Nantucket is the only urban town in the sub-basin and in 1950 had a population of 3,484, nearly 40 percent of the total sub-basin population. The islands showed a gain of 47 persons over the 1940 census.

Recreation is the largest source of employment and income and this sub-basin has been extensively developed for this purpose. The exact income from recreation is not available but probably is several million dollars annually. Agriculture produces an annual income which approaches a half million dollars and commercial fishing activities contribute to the local economy. Manufacturing is on a very small scale and no income figures are available as these would reveal individual incomes.

Uses of the Water Resources

There is no use of the surface water resources for public water supply at present. Four of the eight towns in the Islands Sub-basin have public supplies, all of which are derived from the ground water resources.

The most extensive and economically valuable use of the water resources is for all types of water recreation. Being islands, the coastline is proportionately long per square mile of land area. The islands contain extensive sandy beaches, sheltered harborage and inland lakes and ponds that serve the purposes of recreational bathing, game fishing and boating.

Other uses served by the water resources are for commercial fishing and shellfish operations and for agricultural purposes.

Pollution Contributed to the Water Resources

There are no sources of industrial waste pollution in the Islands Sub-basin nor are there any sources of sewage pollution contributed to by 30 persons or more.

There are, however, scattered individual sewer outlets from private homes and summer camps and residences that discharge into nearby watercourses or shallow coastal waters. Individually these sources of pollution are small, but collectively they constitute a significant water pollution problem.

Damages to Water Resources from Pollution

The amount of pollution from private sewers discharged into Nantucket Harbor in the thickly settled portion of the town is sufficient to have caused the closing of nearby shore areas to the taking of shellfish.

These and other sources of sewage pollution from private outlets also exist as a potential menace to the health of those bathing in or making other recreational use of the water resources, unaware of the existence of sewage pollution. Although possibly remote, this health hazard should be considered serious in this well-patronized recreational area.

Pollution Control Measures in Effect

The town of Nantucket operates two municipal sewage treatment plants which serve the thickly populated area in the town and have a connected population of 9,600 persons including summer residents. The effluents from these secondary sewage treatment plants are dischargod to ground water, a satisfactory method of disposal.

Since the effluents are discharged to ground water and cause no pollution of streams, Nantucket town has not been counted as a source of pollution in this report.

Pollution Control Measures Required

Field surveys are needed to determine the location of all sources of pollution from private sewer outlets in the Islands Sub-basin and the individuals responsible for these sources of pollution required to construct adequate subsurface sewage disposal for each outlet.

These projects are needed to protect the health and welfare of the residents and visitors to the Islands, however remote one may desire to view the chances for waterborne disease, and to permit the fullest practicable use and enjoyment of the Islands water resources. The cost for these needed individual sewage disposal projects is very low in relation to the high value of the available water resources and the reputation of the Islands Sub-basin as a recreation area.

Table A12
BASIC DATA ON SOURCES OF MUNICIPAL AND INDUSTRIAL POLLUTION
The Islands Sub-basin

Source of Pollution and Receiving Watercourse	Number Sewered or Type of Wastes	P.E. 1/ Untreated Wastes	Treatment		P.E. 1/ to Water-course	Waste Treatment Requirements	Current Status of Required Projects
			Kind	Status 2/			
Atlantic Ocean							
Nantucket town	9,600	9,600	Secondary	S	0 (ground water)	None	

1/ P.E. - Population equivalent in terms of biochemical oxygen demand.
2/ S - Satisfactory.

APPENDIX
TO
REPORT ON WATER POLLUTION
MASSACHUSETTS COASTAL STREAMS BASIN
1952

APPENDIX "A" - Basic Data on Municipal Sources of Pollution

APPENDIX "B" - Basic Data on Industrial Sources of Pollution

APPENDIX "C" - 1940 and 1950 Populations of Cities and Towns

APPENDIX "D" - Census of Public Water Supplies

APPENDIX "E" - Census of Institutional Water Supplies

APPENDIX "F" - Synopsis of State and Federal Water Pollution Control Legislation in Effect

APPENDIX "A"

BASIC DATA ON SOURCES OF MUNICIPAL* POLLUTION
MASSACHUSETTS COASTAL STREAMS BASIN

Name and Location ***	Population Served by Sewers	P.E. (B.O.D.) Untreated Wastes**	Waste Treatment Provided	Adequacy of Treatment Facilities		P.E. (B.O.D.) Disch. to Water-course**	Treatment Needs	Current Status Municipal Action*
				Cap.	Opr.			
Ipswich River (main stem)								
Ipswich (T)	2,000	2,000	No Municipal System			2,000	Sewers; New Plant	Final Plans App.
--Vet. Housing Proj.	200	200	Secondary	Sat.	Sat.	10	None	---
--Old Vet. Housing Proj.	100	100	Secondary	Uns.	Uns.	25	Additions	Inactive
Farley Brook (Ipswich Basin)								
Ipswich (T)	500	500	No Municipal System			500	New Plant 1/	Final Plans App.
Martin's Brook (Ipswich R. Basin)								
Wilmington (T)	300	300	Private cesspools	Uns.	Uns.	200	Individual Treatment	Inactive
N. Reading (T) --State Sanitarium	165	165	Secondary	Sat.	Sat.	Neg.	None	---

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1/ Private sewers on Farley Brook and main stem Ipswich River to be served by 1 sewerage system.

Name and Location ***	Population Served by Sewers	P.E. (B.O.D.) Untreated Wastes**	Waste Treatment Provided	Adequacy of Treatment Facilities		P.E. (B.O.D.) Disch. to Watercourse**	Treatment Needs	Current Status Municipal Action*
				Cap.	Opr.			
Atlantic Ocean								
Rockport (T)	2,000	2,000E	None 1/	-	-	2,000	Additions	Final Plans App.
Gloucester (C)	18,000	60,400	None 1/	Sat.	Sat.	60,400	None	---
Gloucester (C)	76	76	Private Sewers			76	Individual Treatment	Under construction
--E. Gloucester	1,000	6,000	None	-	-	6,000	Conn. to M.S.	Under construction
Manchester (T)	1,800	1,800	None 1/	-	-	1,800	Additions	Action requested
Manchester (T)	116	116	Private Sewers			116	Ind.Treat. or Conn. to M.S.	Under construction
South Essex Sewerage District 2/	84,400	406,000	Minor 1/ (part)	Uns.	Sat.	406,000	Additions	Action requested
--Salem (C)	40,200	(Served by	South Essex Sewerage			District)		
--Salem (C)	64	64	Private Sewers			64	Ind. Treat. or Conn. to M.S.	Under construction
--Beverly (C)	22,500	(Served by	South Essex Sewerage			District)		
--Beverly (C)	332	332	Private Sewers			332	Ind. Treat. or Conn. to M.S.	Under construction

1/ Ocean outfall.
2/ Serves sewered areas in Salem, Beverly, Peabody and Danvers.

Name and Location ***	Population Served by Sewers	P.E. (B.O.D.) Untreated Wastes**	Waste Treatment Provided	Adequacy of Treatment Facilities		P.E. (B.O.D.) Disch. to Watercourse**	Treatment Needs	Current Status Municipal Action*
				Cap.	Opr.			
Atlantic Ocean								
So. Essex Sewerage District (Cont.)								
—Peabody (C)	19,700	(Served	by South Essex	Sewerage		District)		
—Danvers (T)	2,000	(Served	by South Essex	Sewerage		District)		
—Danvers (T)	220	220	Private Sewers			220	Ind. Treat. or Conn. to M. S.	Under Construction
Marblehead (T)	10,800	10,800	None 1/			10,800	Additions	Action Requested
Marblehead (T)	332	332	Private Sewers			332	Ind. Treat. of Conn. to M. S.	Under Construction
Swampscott (T)	10,700	10,700	Minor 1/	Sat.	Sat.	10,700	None	
Nahant (T)	2,000	2,000	None 1/			2,000	New Plant, Sewers 2/	Under Construction
Lynn (C)	98,200	353,000	Minor 1/	Sat.	Sat.	353,000	None	
Saugus (T) 3/	4,350	4,350	Minor 1/	Uns.	Sat.	4,350	Additions 4/	Under Construction
Saugus (T)	500	500	Private Sewers			500	Conn. to M.S.	Inactive

1/ Ocean outfall.
2/ Provide satisfactory outfall.
3/ Discharges to Lynn outfall sewer.
4/ Comminutor.

Name and Location ***	Population Served by Sewers	P.E. (B.O.D.) Untreated Wastes**	Waste Treatment Provided	Adequacy of Treatment Facilities		P.E. (B.O.D.) Disch. to Water-course**	Treatment Needs	Current Status Municipal Action*
				Cap.	Opr.			
Boston Harbor								
North M. D. C. 1/	712,980	1,620,000	None 2/	-	-	1,620,000 3/	New Plant	Preliminary Plans Approved
—Arlington (T)	42,860	(Served by	M. D. C.)					
—Belmont (T)	22,580	"	"					
—Boston (C)	79,300	"	"					
—Cambridge (C)	120,500	"	"					
—Chelsea (C)	38,930	"	"					
—Everett (C)	45,500	"	"					
—Lexington (T)	5,780	"	"					
—Malden (C)	57,900	"	"					
—Medford (C)	65,990	"	"					
—Melrose (C)	26,850	"	"					
—Reading (T)	3,970	"	"					
—Revere (C)	31,790	"	"					
—Somerville (C)	102,100	"	"					
—Stoneham (T)	10,270	"	"					
—Wakefield (T)	11,650	"	"					
—Winchester (T)	15,530	"	"					
—Winthrop (T)	19,480	"	"					
—Woburn (C)	12,000	"	"					

1/ Metropolitan District Commission.

2/ Ocean outfall.

3/ Based on six 24-hour composited samples collected by Charles A. Maguire & Assoc. on six different days during the period July 31–August 30, 1951.

Name and Location ***	Population Served by Sewers	P.E. (B.O.D.) Untreated Wastes**	Waste Treatment Provided	Adequacy of Treatment Facilities		P.E. (B.O.D.) Disch. to Watercourse**	Treatment Needs	Current Status Municipal Action*
				Cap.	Opr.			
Boston Harbor								
Boston Main Drainage --Boston (C)	453,000	545,800	None 1/	-	-	545,800	New Plant 2/	Preliminary Plans Approved
South M. D. C.	640,890	1,032,000 3/	Primary Chlorination	Sat.	Sat.	516,000	None	
--Boston (C)	277,820	(Served by M. D. C.)						
--Braintree (T)	8,060	"	"					
--Brookline (T)	56,940	"	"					
--Canton (T)	1,310	"	"					
--Dedham (T)	11,740	"	"					
--Milton (T)	19,580	"	"					
--Needham (T)	7,770	"	"					
--Newton (C)	76,140	"	"					
--Norwood (T)	14,130	"	"					
--Quincy (C)	80,200	"	"					
--Stoughton (T)	1,110	"	"					
--Walpole (T)	2,100	"	"					
--Waltham (C)	33,860	"	"					
--Watertown (T)	37,270	"	"					
--Wellesley (T)	12,350	"	"					
--Weymouth (T)	510	"	"					

1/ Ocean outfall .

2/ North M. D. C. and Boston Main Drainage to same plant .

3/ Based on the average figures determined at the Nut Island Sewage Treatment Plant for the month of November 1951.

Name and Location ***	Population Served by Sewers	P.E. (B.O.D.) Untreated Wastes**	Waste Treatment Provided	Adequacy of Treatment Facilities		P.E. (B.O.D.) Disch. to Watercourse**	Treatment Needs	Current Status Municipal Action*
				Cap.	Opr.			
Charles River (main stem)								
Milford (T)	9,000	38,350	Secondary	Sat.	Sat.	390	None	
Medway (T)	200	200	None 1/	-	-	200	New Plant	Active Planning
Millis (T)	200	85	Secondary	Sat.	Sat.	Neg.	None	
Medfield (T)	500	500	Secondary	Sat.	Sat.	50	None	
--Medfield State Hos.	2,300	2,300	Secondary	Sat.	Sat.	55	None	
Mine Brook (Charles R. Basin)								
Franklin (T)	3,900	5,870	Secondary	Uns.	Sat.	750	Additions	Active Planning
Stop River (Charles R. Basin)								
Norfolk (T)								
--Pondville State Hos.	245	245	Secondary	2/	Sat.	Neg.	Chlorination	Active Planning
--State Prison	900	900	Secondary	2/	Sat.	Neg.	Chlorination	Active Planning
Wrentham (T)								
--State School	1,940	1,940	Secondary	2/	Sat.	Neg.	Chlorination	Active Planning

1/ Emergency chlorinator installed in summer 1951.

2/ Capacity adequate but location of plant requires chlorination of effluent.

Name and Location ***	Population Served by Sewers	P.E. (B.O.D.) Untreated Wastes**	Waste Treatment Provided	Adequacy of Treatment Facilities		P.E. (B.O.D.) Disch. to Watercourse**	Treatment Needs	Current Status Municipal Action*
				Cap.	Opr.			
Bogastow Brook (Charles R. Basin)								
Holliston (T)	100	100	No Municipal System			100	New Plant 1/ or Ind. Treatment	Inactive
Unnamed Brook (Charles R. Basin)								
Weston (T) --Regis College	475	475	Secondary	Sat.	Sat.	24	None	
Cherry Brook (Charles R. Basin)								
Weston (T) --Weston College	270	270	Secondary	Sat.	Sat.	Neg.	None	
Neponset River (main stem)								
Foxboro (T) --Foxboro State Hos.	1,500	1,500	Secondary	Sat.	Sat.	26	None	
Cochato River to Monatiquot River to Weymouth Fore River								
Braintree (T) --Norfolk County Hos.	145	145	Secondary	Sat.	Sat.	Neg.	None	

1/ Studies needed to determine sewerage and sewage treatment needs.

Name and Location ***	Population Served by Sewers	P.E. (B.O.D.) Untreated Wastes**	Waste Treatment Provided	Adequacy of Treatment Facilities		P.E. (B.O.D.) Disch. to Watercourse**	Treatment Needs	Current Status Municipal Action*
				Cap.	Opr.			
Cochato River to Monatiquot River to Weymouth Fore River								
Randolph (T) --Boston School for Deaf	200	200	Secondary	Sat.	Sat.	None 1/	None	
Weymouth (T) --Homestead School	300	300	Secondary	Sat.	Sat.	30	None	
Mill River								
Weymouth (T) --So. Shore Hospital	150	150	Secondary	Sat.	Sat.	Neg.	None	
Weir River								
Hull (T)	2,170	2,170	None	-	-	2,170	Sewers; Ocean Outfall	Inactive
James River								
Cohasset (T)	850	850	No Municipal System			850	Sewers; New Plant 2/	Preliminary Plans Approved
Atlantic Ocean								
Scituate (T) --Scituate (V)	400	400	No Municipal System			400	New Plant 2/	Preliminary Plans Approved
--Scituate Center	200	200	No Municipal System			200	New Plant	Inactive

1/ Effluent discharged to ground water.

2/ Sewerage system and pretreatment prior to ocean outfall sewer.

Name and Location ***	Population Served by Sewers	P.E. (B.O.D.) Untreated Wastes**	Waste Treatment Provided	Adequacy of Treatment Facilities		P.E. (B.O.D.) Disch. to Water-course**	Treatment Needs	Current Status Municipal Action*
				Cap.	Opr.			
French Stream (North Basin)								
Weymouth (T) --Weymouth Naval Air Station	N 1/	N 1/	Secondary	Sat.	Sat.	N 1/	None	
Rockland (T)	400	400	Private sewers			400	Sewers; New Plant	Inactive
--High School	500	175	Secondary	Sat.	Sat.	10	None	
Abington (T) --N. Abington	750	750	Secondary	Uns.	Uns.	375	Replacement; sewers	Final Plans App. Inactive
Indian Head Brook (North Basin)								
Hanson (T) --Plymouth Co. Hosp.	155	155	Secondary	Sat.	Sat.	Neg.	None	
Herring Brook (North Basin)								
Hanover (T) --St. Coletta School By-The-Sea	85	85	Secondary	Sat.	Sat.	Neg.	None	
Unnamed Brook to French Stream (North Basin)								
Rockland (T)	600	600	None			600	New Plant; sewers	Inactive
--Jefferson School	230	230	Secondary	Sat.	Sat.	23	None	

1/ Populations served at military installations are not given.

Name and Location ***	Population Served by Sewers	P.E. (B.O.D.) Untreated Wastes**	Waste Treatment Provided	Adequacy of Treatment Facilities		P.E. (B.O.D.) Disch. to Water-course**	Treatment Needs	Current Status Municipal Action*
				Cap.	Opr.			
Atlantic Ocean and Small Coastal Streams								
Marshfield (T)	200	200	No Municipal System			200	New Plant1/	Inactive
Halls Brook (Jones Basin)								
Kingston (T)	200	200	No Municipal System			200	New Plant2/	Inactive
Plymouth Harbor								
Plymouth (T)	11,000	11,000	None	-	-	11,000	New Plant	Preliminary Plans Approved
Cape Cod Canal								
Bourne (T) --Sagamore Apts.	125	125	Secondary	Uns.	Uns.	50	Additions	Active Planning
Cape Cod Bay								
Provincetown (T)	1,000	1,000	Private cesspools	Sat.	Sat.	0 3/	None	
Wellfleet (T) --Camp Wellfleet	4/ N	4/ N	Secondary	Sat.	Sat.	4/ N	None	

1/ Sewerage system and sewage disposal works for thickly settled portion of town.
2/ Sewerage system and disposal works or individual treatment projects.
3/ Subsurface disposal.
4/ Populations served at military installations are not given.

Name and Location ***	Population Served by Sewers	P.E. (B.O.D.) Untreated Wastes**	Waste Treatment Provided	Adequacy of Treatment Facilities		P.E. (B.O.D.) Disch. to Water-course**	Treatment Needs	Current Status Municipal Action*
				Cap.	Opr.			
Atlantic Ocean								
Barnstable (T)	250	250	Secondary	Sat.	Sat.	25	None	
--Hyannis (V)	3,000	3,000	Secondary	Sat.	Sat.	0 2/	None	
Falmouth (T)								
--Camp Edwards	N 3/	N 3/	Secondary	Sat.	Sat.	0 2/	None	
--Woods Hole (V)	150	150	None 1/	Sat.	Sat.	150	None	
Morse Pond to Falmouth Inner Harbor								
Falmouth (T) --Falmouth Housing Project	225	225	Secondary	Sat.	Sat.	25	None	
Buzzards Bay								
Marion (T)	1,000	1,000	Secondary	Sat.	Sat.	100	None	
Mattapoisett (T)	400	400	No Municipal System			400	New Plant	Inactive
Acushnet River								
Fairhaven (T)	9,000	9,000	None	-	-	9,000	New Plant	Preliminary Plans Approved
Buzzards Bay								
New Bedford (C)	111,000	412,000	Minor 1/	Uns.	Sat.	412,000	Additions	Active Planning
Dartmouth (T)			(Served by New Bedford)					
Atlantic Ocean								
Nantucket (T)	9,600	9,600 (Summer)	Secondary (2 plants)	Sat.	Sat.	0 2/	None	

1/ Ocean outfall.
2/ Subsurface disposal.
3/ Populations served at military installations are not given.

APPENDIX "A"

FOOT NOTES

* Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers or other population centers.

** Includes industrial wastes discharged into municipal sewerage systems; N - Information not available or undetermined; Neg. - Negligible.

*** C - City; T - Town; V - Unincorporated Village

APPENDIX "B"

BASIC DATA ON SOURCES OF INDUSTRIAL* POLLUTION

MASSACHUSETTS COASTAL STREAMS BASIN

Name and Location***	River Mile Above Outlet Stream	Type Industry**	Type Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd to Watercourse	Pollution Abatement Needs	Current Status Industrial* Action
				Degree	Adequacy Cap.	Adequacy Opr.			
Parker River (main stem)									
Newbury (T) —Tobacco 1/		Miscellaneous	Sanitary Sewage	None	-	-	5	Subsurface Disposal	Action Requested
Ipswich River (main stem)									
Middleton (T) —Shoe & Leather Finishes	A 24	Chemical, etc.	Organic	Secondary	Sat.	Sat.	31	None	—
Ipswich (T)									
--Slaughterhouse	A 4	Food, etc.	Organic	Cesspools	Sat.	Sat.	0 2/	None	---
--Electrical Goods	A 4	Misc.	Sanitary Sewage	None	-	-	170	Conn.to M.S.	Inactive 3/

1/ Not counted in report as source of pollution but requires treatment for sanitary sewage from 15 employees in accordance with State health department policy.

2/ Subsurface disposal.

3/ Awaiting action by town to provide municipal sewage system.

Name and Location***	River Mile Above Outlet Stream	Type Industry**	Type Waste Produced	Treatment or Other Pollution Control Measures			P. E. (B.O.D.) Disch'd to Watercourse	Pollution Abatement Needs	Current Status Industrial* Action
				Degree	Adequacy				
					Cap.	Opr.			
Lubber Brook (Ipswich Basin)									
Wilmington (T) N. Wilmington (V) --Tannery	I 1.5	Lea., etc.	Organic	Secondary	Uns.	Uns.	1,250	Additions	Inactive 1/
North River (Danvers Basin)									
Peabody (C) --Chemical Mfg.	D 3	Chem., etc.	Organic	Primary	Uns.	Uns.	125	Conn. to M.S.	Final Plans Approved
Danvers River (main stem)									
Danvers (T) --Tannery	D 3	Lea., etc.	Organic	Primary	Sat.	Sat.	15	None	---
--Tannery 2/	D 3	Lea., etc.	Sanitary	None	-	-	15	Conn. to M.S.	Active
Bass River (Danvers Basin)									
Beverly (C) --Metal Hydrides		Chem., etc.	Inorgan.	None	-	-	Does not apply	None 3/	---

1/ Pending results of local board of health action to abate nuisance conditions.
2/ Not counted in report as source of pollution but requires project for sewage from 45 employees in accordance with State health department policy.
3/ Dilution satisfactory method of disposal for the present.

Name and Location***	River Mile Above Outlet Stream	Type Industry**	Type Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd to Water-course	Pollution Abatement Needs	Current Status Industrial* Action
				Degree	Adequacy Cap.	Adequacy Opr.			
Mystic River (main stem)									
Everett (C)									
--Coke Ovens 1/	BH 3	Petr., etc.	Inorgan.	Primary	Uns.	Sat.	Does not apply	Additions	Inactive
--Gas Mfg.		Petr., etc.	Inorgan.	Primary	Uns.	Sat.	Does not apply	Additions	Inactive
--Tar Refinery 1/	BH 3	Petr., etc.	Inorgan.	Primary	Uns.	Sat.	Does not apply	Additions	Inactive
--Oil Refinery 1/	BH 3	Petr., etc.	Inorgan.	Primary	Uns.	Sat.	Does not apply	Additions	Inactive
--Chemical Mfg.		Chem., etc.	Inorgan.	None	-	-	Does not apply	Conn.to M.S.	Active
Malden River (Mystic Basin)									
Malden (C)									
--Gas Mfg.		Petr., etc.	Inorgan.	Primary	Uns.	Sat.	Does not apply	Additions	Inactive
Charles River (main stem)									
Milford (T)									
--Hat Mfg.		Textl., etc.	Organic	None	-	-	75	Conn.to M.S.	Inactive
--Rubber Coated Textiles		Textl., etc.	Organic	None	-	-	25	Conn.to M.S.	Active
Bellingham (T)									
--Wool Scouring	BH 33	Textl., etc.	Organic	Intermed.	Sat.	Sat.	3,100	None 2/	---
--Dye & Finish Wool	BH 33	Textl., etc.	Organic	Primary	Uns.	Sat.	5,550	Additions	Inactive

1/ Waste discharged to Island End River a short distance from the Mystic River.
2/ No project required until better treatment method for wool scouring wastes is devised.

Name and Location***	River Mile Above Outlet Stream	Type Industry**	Type Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd to Water-course	Pollution Abatement Needs	Current Status Industrial* Action
				Degree	Adequacy Cap.	Adequacy Opr.			
Charles River (main stem)									
Medway (T) --Woolen Mill	BH 28	Textl., etc.	Organic; San. Sew.	None	-	-	2,440	New Plant or Conn. to M.S.	Inactive
--Laundry	BH 28	Miscellaneous	Organic	None	-	-	60	New Plant or Conn. to M.S.	Inactive
Mine Brook (Charles Basin)									
Franklin (T) --Felt Mfg.	C 5.5	Textl., etc.	Organic	None	-	-	1,100	Pretreatment and Conn. to M.S.	Final Plans Approved
Unnamed Brook (Charles Basin)									
Millis (T) --Asphalt Shingles		Petr., etc.	Inorganic	None	-	-	Does not apply	New Plant	Active
Neponset River (main stem)									
Walpole (T) --Paper Mill	DB 19	Paper, etc.	Organic	Primary	Uns.	Sat.	22,000	Additions	Inactive
--Paper Mill	DB 19	Paper, etc.	Organic	Primary	Uns.	Sat.	12,000	Additions	Inactive

Name and Location***	River Mile Above Outlet Stream	Type Industry**	Type Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd to Water-course	Pollution Abatement Needs	Current Status Industrial* Action
				Degree	Adequacy				
					Cap.	Opr.			
Neponset River (main stem)									
Boston (C) (Hyde Park) --Paper Mill	DB 4	Paper, etc.	Organic	Minor	Sat.	Sat.	140	None 1/	---
East Branch (Neponset Basin)									
Canton (T) --Chicken Slaughterhouse	C 3	Food, etc.	Organic	Cesspools	Uns.	Uns.	100	Conn.to M.S.	Action Requested
--Rubber Mfg.	C 3	Rubber, etc.	Organic	Primary	Uns.	Uns.	Does not apply	Conn.to M.S.	Action Requested
Quincy Bay									
Quincy (C) --Detergent Mfg.	-	Chem., etc.	Organic	Secondary (Equiva.)	Sat.	Sat.	10,700	None	---
Weymouth Fore River									
Weymouth (T) --Dairy		Food, etc.	Organic	Cesspools	Uns.	Uns.	100	Additions or Conn.to M.S.	Action Requested
Weymouth Back River									
Weymouth (T) --Wool Scouring	HB 4	Textl., etc.	Organic	None	-	-	10,000	New Plant or Conn.to M.S.	Inactive

---

1/ Save-alls on all paper machines, satisfactory treatment at present; 22,000 gal./day white water overflows to river, remaining 1.22 M.G.D. white water to public sewers.

Name and Location***	River Mile Above Outlet Stream	Type Industry**	Type Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd to Watercourse	Pollution Abatement Needs	Current Status Industrial* Action
				Degree	Adequacy				
					Cap.	Opr.			
Mill River (Weymouth Back River Basin)									
Weymouth (T) --Laundry		Miscellaneous	Organic	Secondary	Uns.	Sat.	40	Additions	Action Requested
Satuit Brook to Scituate Harbor									
Scituate (T) --Laundry	A 2	Miscellaneous	Organic	Secondary	Sat.	Sat.	Negligible	None	---
French Stream (North Basin)									
Abington (T) --Ice Cream Mfg.		Food, etc.	Organic	Primary	Uns.	Uns.	280	Replacement	Action Requested
Pudding Brook (North Basin)									
Pembroke (T) --Wooden Boxes 1/		Lumber, etc.	Sanitary Sewage	Primary	Uns.	Uns.	10	Additions	Inactive
Jones River (main stem)									
Kingston (T) --Woolen Mill		Textl., etc.	Organic; San. Sew.	None	-	-	2,550	New Plant	Action Requested
--Laundry		Miscellaneous	Organic; San. Sew.	None	-	-	100	New Plant	Inactive

1/ Not counted as a source of pollution in this report but project for sanitary sewage from about 45 employees required by State health department policy.

Name and Location***	River Mile Above Outlet Stream	Type Industry**	Type Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd to Water-course	Pollution Abatement Needs	Current Status Industrial* Action
				Degree	Adequacy				
					Cap.	Opr.			
Halls Brook (Jones Basin)									
Kingston (T) --Hand Tools 1/		Fabricated, etc.	Sanitary Sewage	None	-	-	10	Subsurface Disposal	Inactive
Smelt Brook (Jones Basin)									
Kingston (T) --Rivets		Fabricated, etc.	Inorganic; San. Sew.	None	-	-	Does not apply	New Plant	Inactive
Plymouth Harbor									
Plymouth (T) --Cordage Mfg.	-	Textile, etc.	Sanitary Sewage	None	-	-	1,040	Conn. to M.S.	Inactive
Onset Bay									
Wareham (T) --Cranberry Processing		Food, etc.	Organic	Secondary	Sat.	Sat.	0 2/	None	---
Wareham River (main stem)									
Wareham (T) --Nail Mfg.		Fabricated, etc.	Inorganic	None	-	-	Does not apply	None 3/	---
--Laundry		Miscellaneous	Organic	None	-	-	340	New Plant	Inactive

1/ Not counted as a source of pollution in this report but project for sanitary sewage from about 30 employees required by State health department policy.

2/ Effluent to Dry Wells.

3/ Dilution satisfactory method of disposal for the present.

Name and Location***	River Mile Above Outlet Stream	Type Industry**	Type Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd to Watercourse	Pollution Abatement Needs	Current Status Industrial* Action
				Degree	Adequacy				
					Cap.	Opr.			
Buzzards Bay									
Fairhaven (T) --Tack Mfg.		Fabricated, etc.	Inorganic; San. Sew.	Minor Minor	Uns. Uns.	Uns. Uns.	Does not apply 100	Additions Conn. to M.S.	Inactive Inactive
Acushnet River									
Acushnet (T) --Golf Ball Mfg.		Rubber, etc.	Organic	None	-	-	216	New Plant	Action Requested
New Bedford (C) --Brass Mill		Primary, etc.	Inorganic; San. Sew.	None None	- -	- -	Does not apply 237	Conn. to M.S.	Action Requested
Cape Cod Canal									
Sandwich (T) --Fish and Cranberry Processing		Food, etc.	Organic	None	-	-	N 1/	New Plant	Inactive
Cape Cod Bay									
Barnstable (T) --Fish and Cranberry Processing		Food, etc.	Organic	None	-	-	N 1/	New Plant	Inactive
Provincetown Harbor									
Provincetown (T) --Fish Processing --Fish Processing		Food, etc. Food, etc.	Organic Organic	None None	- -	- -	N 1/ N 1/	New Plant New Plant	Inactive Inactive

1/ Population equivalents not available--Wastes result from processing fish 3 months/year Maximum of 40,000 pounds/day during fish season.

Name and Location ***	River Mile Above Outlet Stream	Type Industry**	Type Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd to Water-course	Pollution Abatement Needs	Current Status Industrial* Action
				Degree	Adequacy				
					Cap.	Opr.			
Provincetown Harbor									
Truro (T) N. Truro (V) --Fish Processing		Food, etc.	Organic	None	-	-	N 1/	New Plant	Inactive
Stepping Stone Brk. to Pleasant Bay									
Chatham (T) --Laundry		Miscellaneous	Organic	Secondary	Uns.	Uns.	Unknown	Additions	Inactive
Lewis Bay									
Yarmouth (T) W. Yarmouth (V) --Laundry		Miscellaneous	Organic	Secondary	Sat.	Sat.	0 2/	None	---
Vineyard Sound									
Falmouth (T) --Laundry		Miscellaneous	Organic	Secondary	Sat.	Sat.	0 2/	None	---

1/ Population equivalents not available--Wastes result from processing fish 3 months/year Maximum of 40,000 pounds/day during fish season.

2/ Subsurface disposal.

APPENDIX "B"

FOOT NOTES

* Industries having separate outlets and discharging wastes directly to watercourse.

** List of Industries

Food and kindred products
Textile mill products
Lumber and wood products (except furniture)
Paper and allied products
Chemicals and allied products
Products of petroleum and coal
Rubber products
Leather and leather products
Primary metal industries
Fabricated metal products (except ordnance, machinery and transportation equipment)
Miscellaneous manufacturing industries

*** C - City; T - Town; V - Unincorporated Village
In keeping with the policy of the Massachusetts Department of Public Health, the names of manufacturing establishments are not given but their product is given.

N Information not available or undetermined.

APPENDIX "C"

1940 and 1950 POPULATIONS OF CITIES AND TOWNS, MASSACHUSETTS COASTAL STREAMS BASIN 1/

Place	1940 Population	1950 Population
BARNSTABLE COUNTY	37,295	46,805
Barnstable town *	8,333	10,480
Bourne town	3,315	4,720
Brewster town	827	987
Chatham town	2,136	2,457
Dennis town	2,015	2,499
Eastham town	582	860
Falmouth town	6,878	8,662
Harwich town	2,535	2,649
Mashpee town	434	438
Orleans town	1,451	1,759
Provincetown town *	3,668	3,795
Sandwich town	1,360	2,418
Truro town	585	661
Wellfleet town	890	1,123
Yarmouth town	2,286	3,297
BRISTOL COUNTY	139,165 2/	142,858 2/
Acushnet town	4,145	4,401
Dartmouth town *	9,011	11,115
Fairhaven town *	10,938	12,764
Freetown town	630 2/	475 2/
New Bedford city *	110,341	109,189
Westport town	4,100 2/	4,914 2/
DUKES COUNTY	5,669	5,633
Chilmark town	226	183
Edgartown town	1,370	1,508
Gay Head town	127	88
Gosnold town	136	56
Oak Bluffs town	1,584	1,521
Tisbury town	1,966	1,930
West Tisbury town	260	347
ESSEX COUNTY	291,601 2/	314,770 2/
Beverly city *	25,537	28,884
Boxford town	778	926

Place	1940 Population	1950 Population
ESSEX COUNTY (Cont.)		
Danvers town *	14,179	15,720
Essex town	1,384	1,794
Georgetown town	1,803	2,411
Gloucester city *	24,046	25,167
Hamilton town	2,037	2,764
Ipswich town *	6,348	6,895
Lynn city *	98,123	99,738
Lynnfield town	2,287	3,927
Manchester town	2,472	2,868
Marblehead town *	10,856	13,765
Middleton town	2,348	2,916
Nahant town	1,835	2,679
Newbury town	1,599	1,994
Peabody city *	21,711	22,645
Rockport town *	3,556	4,231
Rowley town	1,533	1,768
Salem city *	41,213	41,880
Saugus town *	14,825	17,162
Swampscott town *	10,761	11,580
Topsfield town	1,150	1,412
Wenham town	1,220	1,644
MIDDLESEX COUNTY	722,690 2/	786,853 2/
Arlington town *	40,013	44,353
Belmont town *	26,867	27,381
Burlington town	1,138 2/	1,569 2/
Cambridge city *	110,879	120,740
Everett city *	46,784	45,982
Holliston town	3,000	3,753
Lexington town *	6,593 2/	8,549 2/
Lincoln town	1,783	2,427
Malden city *	58,010	59,804
Medford city *	63,083	66,113
Melrose city *	25,333	26,988
Natick town *	6,926 2/	9,831 2/
Newton city *	69,873	81,994
North Reading town	2,886	4,402
Reading town *	10,866	14,006
Sherborn town	1,022	1,245
Somerville city *	102,177	102,351
Stoneham town *	10,765	13,229
Wakefield town *	16,223	19,633

Place	1940 Population	1950 Population
MIDDLESEX COUNTY (Cont.)		
Waltham city *	40,020	47,187
Watertown town *	35,427	37,329
Weston town	3,590	5,026
Wilmington town	4,600 2/	6,960 2/
Winchester town *	15,081	15,509
Woburn city *	19,751	20,492
NANTUCKET COUNTY	3,401	3,484
Nantucket town *	3,401	3,484
NORFOLK COUNTY	314,306 2/	379,113 2/
Avon town	1,163 2/	1,331 2/
Bellingham town	2,919 2/	4,020 2/
Braintree town *	16,378	23,161
Brookline town *	49,786	57,589
Canton town *	6,381	7,465
Cohasset town	3,111	3,731
Dedham town *	15,508	18,487
Dover town	1,374	1,722
Franklin town *	7,303	8,037
Holbrook town	3,330	4,004
Medfield town	4,384	4,549
Medway town	3,297	3,744
Millis town	2,278	2,551
Milton town *	18,708	22,395
Needham town *	12,445	16,313
Norfolk town	2,294	2,704
Norwood town *	15,383	16,636
Quincy city *	75,810	83,835
Randolph town *	7,634	9,982
Sharon town	3,737	4,847
Stoughton town *	8,632	11,146
Walpole town *	7,443	9,109
Wellesley town *	15,127	20,549
Westwood town	3,376	5,837
Weymouth town *	23,868	32,690
Wrentham town	2,337 2/	2,679 2/
PLYMOUTH COUNTY	63,890 2/	79,453 2/
Abington town	950 2/	1,000 2/

Place	1940 Population	1950 Population
PLYMOUTH COUNTY (Cont.)		
Carver town	1,101	1,530
Duxbury town	2,359	3,167
Hanover town	2,875	3,389
Hanson town	475 2/	500 2/
Hingham town *	8,003	10,665
Hull town	2,167	3,379
Kingston town	2,783	3,461
Marion town	2,030	2,250
Marshfield town	2,419	3,267
Mattapoisett town	1,608	2,265
Middleborough town *	1,806 2/	2,028 2/
Norwell town	1,871	2,515
Pembroke town	1,718	2,579
Plymouth town *	13,100	13,608
Rochester town	1,269	1,328
Rockland town *	8,087	8,960
Scituate town	4,130	5,993
Wareham town	6,364	7,569
SUFFOLK COUNTY	863,248	896,615
Boston city *	770,816	801,444
Chelsea city *	41,259	38,912
Revere city *	34,405	36,763
Winthrop town *	16,768	19,496
WORCESTER COUNTY	15,388 2/	15,405 2/
Milford town *	15,388	15,405
TOTALS	2,456,453	2,670,989

1/ Taken from the Sixteenth Census of the U.S. and advance reports on the Seventeenth Census. Confined to persons residing within the basin.

2/ Estimated population - community partly in basin.

* Classified as urban in 1940.

APPENDIX "D"

CENSUS OF PUBLIC WATER SUPPLIES
MASSACHUSETTS COASTAL STREAMS BASIN, 1952

Community 1/	Population Served	Average Output M.G.D.	Source of Supply 2/	Treatment 3/
Abington (T)	Joint supply with Rockland town 15,400	1.212	Great Sandy Bottom and Little Sandy Bottom Ponds	D.
Acushnet (T)			Served by New Bedford	
Apponagansett (V) (Dartmouth T)			Served by Dartmouth	
Arlington (T)			Served by M.D.C.	
Barnstable (T)				
--Barnstable F.D.			Served by Yarmouth	
—Hyannis (V)	6,000	0.53	Tubular and gravel packed wells	K
—Centerville (V)	1,700 3,500 (summer)	0.197	Gravel packed and tubular wells	None
—Cotult (V)	600 10,000 (summer)	0.133	Gravel packed wells	K
Beechwood (V) (Cohasset T)			Served by Cohasset	
Bellingham (T)	2,980	0.093	Gravel packed wells	None
Belmont (T)			Served by M.D.C.	
Beverly (C)	Served by Salem-Beverly Water Supply Board			
Boston (C)			Served by M.D.C.	

Community 1/	Population Served	Average Output M.G.D.	Source of Supply 2/	Treatment 3/
Bourne (T)	-	-		
--Bourne W.D.	1,500	0.123	Gravel packed wells	None
--Buzzards Bay	850	0.069	Tubular wells	None
--S. Sagamore (V)	400	0.035	Tubular wells	None
--N. Sagamore W.D.	N	-	Tubular wells	None
Braintree (T)	21,800	1.52	Great Pond	CFDK
Brockton (C)	63,350	3.67	Silver Lake	D
Brookville (V) (Holbrook T)			Served by Holbrook	
Brookline (T)	56,900	5.797	Filter Gallery and drift wells, part served by M.D.C.	IF
Cambridge (C)	111,200	16.12	Stony Brook; Hobbs Brook Res. and Fresh Pond; part from M.D.C.	CFDK
Canton (T)	6,780	0.860	Dug, gravel packed and tubular wells	DK
Chatham (T)	2,155	0.182	Tubular and gravel packed wells	K
Chelsea (C)			Served by M.D.C.	
Clifton (V) (Marblehead T)			Included in Marblehead	
Cohasset (T)	3,700	0.39	Dug well	DFCKI
Danvers (T)	16,000	1.41	Middletown & Swan Ponds; Emmerson Brk.	DX
Dartmouth (T)			Served by New Bedford	

Community 1/	Population Served	Average Output M.G.D.	Source of Supply 2/	Treatment 3/
Dedham (T)	17,800	1.495	Gravel packed and tubular wells	None
Dennis (T)	2,000	0.2	Gravel packed wells	None
Duxbury (T)	2,500 4,000 (summer)	0.398	Gravel packed and tubular wells	None
E. Walpole (V) (Walpole T)			Served by Walpole	
E. Wareham (V) (Wareham T)			Served by Wareham	
Edgartown (T)	1,370	0.206	Gravel packed, dug and tubular wells	K
Everett (C)			Served by M.D.C.	
Essex (T)	1,200	0.125	Gravel packed wells	None
Fairhaven (T)	10,070	0.82	Wells	K
Falmouth (T)	6,800	1.05	Long Pond; Driven wells (aux.)	KD
Franklin (T)	7,600	0.565	Gravel packed wells	D
Georgetown (T)	2,010	0.038	Wells	I
Gloucester (C)	24,000	2.76	Impounding reservoirs	D
Gosnald (T)	100	.010	Dug well	K
Hamilton (T)	2,035	0.145	Gravel packed and tubular wells; part served by Essex	K
Hanover (T)	3,100	0.696	Tubular and gravel wall wells	None
Harwich (T)	950 3,170 (summer)	0.288	Gravel packed wells	None

Community 1/	Population Served	Average Output M.G.D.	Source of Supply 2/	Treatment 3/
Hingham (T)	14,200	1.5	Collection system of Fulling Mill Pond; gravel packed well; Accord Pond	KD
Holbrook (T)			Served by Randolph	
Holliston (T)	3,400	0.164	Gravel packed well	None
Hull (T)			Served by Hingham	
Ipswich (T)	6,465	0.501	Dows Brook (Imp.) Gravel wall wells	D None
Islington (V) (Westwood T)			Served by Dedham	
Kingston (T)	2,750	0.249	Gravel packed and tubular wells	None
Lexington (T)			Served by M.D.C.	
Lincoln (T)	2,100	0.350	Sandy Pond	None
Lynn (C)	114,000	11.9	Ponds & Ipswich River	D
Lynnfield (T)	1,025	0.13	Tubular wells Part served by Lynn	None
Malden (C)			Served by M.D.C.	
Manchester (T)	2,600	0.343	Gravel Pond, tubular and dug wells	KD D
Marblehead (T)	10,800	1.23	Dug and driven wells Part served by Lynn	FDI
Marion (T)	2,030	0.188	Gravel packed and tubular wells	None
Marshfield (T)	2,420 20,000 (summer)	0.598	Tubular and gravel packed wells	None

Community 1/	Population Served	Average Output M.G.D.	Source of Supply 2/	Treatment 3/
Mattapoisett (T)	1,610	0.138	Tubular wells	None
Mechanicsville (V) (Bellingham T)			Served by Bellingham	
Medfield (T)	4,100		Served by Medfield State Hospital	K
Medford (C)			Served by M.D.C.	
Medway (T)	3,400	0.25	Gravel packed well Tubular wells (Emerg.)	None D
Melrose (C)			Served by M.D.C.	
Metropolitan District Commission	1,510,040	181.8	Quabbin, Wachusett and Sudbury Res.; Lake Cochituate (emergency supply)	D
Middleton (T)			Served by Danvers	
Milford (T)	18,500	1.07	Charles River and dug wells	FDK
Millis (T)	2,300	0.275	Dug wells	None
Milton (T)			Served by M.D.C.	
Nahant (T)			Served by M.D.C.	
Nantasket Beach (Hull T)			Served by Hull	
Nantucket (T)				
--Siasconset (V)	150	(.564	Dug wells	None
--Wannacomet W. Co.	2,900 13,900 (summer)	(	Tubular and dug wells; Wannacomet Pond (Emerg.)	None
Needham (T)	15,300	1.397	Gravel packed and tubular wells	D (part)

Community 1/	Population Served	Average Output M.G.D.	Source of Supply 2/	Treatment 3/
New Bedford (C)	110,300	15.175	Great and Little Quittica Ponds	D
Newbury (T)	1,400		Part served by Newburyport, tubular wells	CFD
Newton (C)	80,200	6.91	Part served by M.D.C. Dug wells & infiltration gallery	DK
N. Lexington (V) (Lexington T)			Included in Lexington	
N. Reading (T)			Served by Wilmington	
N. Scituate (V) (Scituate T)			Served by Scituate	
Norwood (T)	16,500	1.70	Buckmaster Pond; tubular wells	F
--Ellis Plant			Gravel packed wells	IFK
Oak Bluffs (T)	1,660	0.195	Springs	K
Onset (T)			Served by Wareham	
Peabody (C)	21,700	3.123	Spring Pond; Suntaug Lake; Ipswich River	D
Pembroke (T)	1,550		Served by Brockton	
Plymouth (T)	12,500	1.527	Boot, Little and Great South Ponds, Lout Pond (Emerg.) Gravel packed well	None K
Provincetown (T)	3,670	0.428	Gravel packed wells Tubular wells	FI None
Quincy (C)			Served by M.D.C.	
Randolph (T)	12,600	0.984	Great Pond	CFDK
Reading (T)	10,900	0.888	Tubular wells	FI

Community 1/	Population Served	Average Output M.G.D.	Source of Supply 2/	Treatment 3/
Revere (C)			Served by M.D.C.	
Rockland (T)	Joint supply with Abington			
Rockport (T)	3,560	0.386 0.10	Cape Pond Tubular wells	DFC K
Rowley (T)	1,200	0.125	Tubular wells	None
Salem (C)	Served by Salem-Beverly Water Supply Board			
Salem-Beverly Water Supply Board	71,960	7.30	Wenham Lake, Longham Res.; Ipswich River	CFDK
Saugus (T)			Served by M.D.C.	
Scituate (T)	5,200	0.753	Gravel packed, tubular wells; Spring; Old Oaken Bucket Pond (Emerg.)	K FDK
Sharon (T)	4,200	0.353	Tubular and gravel packed wells; dug and tubular wells (Emerg.)	None
Somerville (C)			Served by M.D.C.	
S. Dartmouth (V) (Dartmouth T)			Served by Dartmouth	
S. Hamilton (V) (Hamilton T)			Served by Hamilton	
S. Hingham (V) (Hingham T)			Served by Hingham	
S. Weymouth (V) (Weymouth T)			Served by Weymouth	
Stoneham (T)			Served by M.D.C.	

Community 1/	Population Served	Average Output M.G.D.	Source of Supply 2/	Treatment 3/
Stoughton (T)	9,200	0.881	Ground water; tubular wells and collection gallery; Muddy Pond	K DK
Swampscott (T)			Served by M.D.C.	
Topsfield (T)	105	.010	Tubular wells	None
Wakefield (T)	16,225	1.114	Crystal Lake	DF
Walpole (T)	8,700	1.315	Tubular wells	None
Waltham (C)			Served by M.D.C. Dug wells (Emerg.)	
Wareham (T)				
--Onset Fire Dist.	2,000 15,000 (summer)	0.276	Jonathan Pond	None
--Wareham Fire Dist.	2,000 7,000 (summer)	0.311	Gravel packed and tubular wells	None
Watertown (T)			Served by M.D.C.	
Wellesley (T)	18,600	2.047	Infiltration gallery, dug, tubular and gravel packed wells	None
Wenham (T)	675	0.053	Tubular wells	None
West Hanover (V) (Hanover T)			Served by Hanover	
W. Medway (V) (Medway T)			Served by Medway	
Weston (T)	4,800	0.337	Tubular, gravel and dug wells	None
--Weston Water Co.	270		Dug wells	None

Community 1/	Population Served	Average Output M.G.D.	Source of Supply 2/	Treatment 3/
--Keewaydin W. Wks.	120		Tubular wells	None
Westwood (T)			Served by Dedham	
Weymouth (T)	29,500	1.887	Great pond and gravel packed well	CFDK
Wilmington (T)	7,675	0.296	Tubular wells	None
Winchester (T)	15,400	1.394	Part served by M.D.C. Reservoirs; gravel packed wells	D
Winthrop (T)			Served by M.D.C.	
Woburn (C)	19,750	1.780	Gravel packed wells	None
Woods Hole (V) (Falmouth T)			Served by Falmouth	
Yarmouth (T)	500 1,000 (summer)	0.244	Gravel packed and tubular wells	K
TOTAL	2,603,110	293.326		

1/ T - Town; C - City; V - Unincorporated Village; F.D. - Fire District; W.Co. - Water Company; W. Wks. - Water Works W.D. - Water District.

2/ M.D.C. - Metropolitan District Commission.

3/ D - Disinfection; F - Filtration; C - Softening; K - Chemical treatment for corrosion correction or water stabilization; X - Fluoridation; I - Iron removal.

APPENDIX "E"

CENSUS OF INSTITUTIONAL WATER SUPPLIES, MASSACHUSETTS COASTAL STREAMS BASIN, 1951

Institution	Population Served	Source of Supply	Treatment 1/
Braintree town			
--Norfolk County Hospital	145	Private supply; Served by Randolph	None CFDK
Falmouth town			
--Camp Edwards	N	Gravel walled wells	D
Hanson town			
--Plymouth County Hospital	155	Deep tubular well	None
Medfield town			
--State Hospital	2,190	Wells	K
Norfolk town			
--Pondville Sanitarium	230	Tubular wells	None
--Prison Colony	1,130	Tubular wells	None
North Reading town			
--State Sanitarium	320	Tubular wells; No. Reading(Emerg.)	None
Weston town			
--Weston College	270	Tubular wells	None
Wrentham town			
--State School	2,315	Tubular wells	X
TOTAL	8,765		

1/ D - Disinfection; F - Filtration; C - Softening; K - Chemical treatment for corrosion correction or water stabilization; X - Fluoridation.

APPENDIX "F"

SYNOPSIS OF STATE AND INTERSTATE WATER POLLUTION CONTROL LEGISLATION IN EFFECT

Massachusetts Department of Public Health

The greater part of Massachusetts authority to control pollution is vested in Chapter 615, titled, "An Act Extending the Authority of the Department of Public Health to Regulate Pollution of Inland and Tidal Waters." This chapter was approved July 17, 1945, and became law on amendment of Section 5 of Chapter 111 of the General Laws by striking the paragraph inserted by Chapter 383 of the Acts of 1941.

The essential features of this law give the State Department of Public Health the power to prescribe and establish rules and regulations to prevent pollution or contamination in any or all of the surface waters within the Commonwealth. The Public Health Council, acting under the authority of Section 5, Chapter 111 of the General Laws, as amended by Chapter 615 of the Acts of 1945, adopted rules and regulations to prevent pollution or contamination of any or all of its surface waters. Those regulations provide that no sewage, human excrement, garbage, manure, or other putrescible matter, no manufacturing refuse or waste product and no refuse or waste product or polluting liquid shall be discharged or put into any surface water within the Commonwealth except as may be approved by the Department of Public Health. The rules and regulations were approved by the Governor and Council September 19, 1945, and as established have the force of law.

Metropolitan District Commission

The authority of the Metropolitan District Commission is contained in Chapter 92 of the General Laws of Massachusetts.

Section 39 states that "The commission may make rules and regulations prohibiting the pollution of the Charles River within the metropolitan parks district. Any person violating any rule or regulation made hereunder shall be punished by fine not exceeding one thousand dollars."

The authority of the Commission to order abatement of pollution within the Charles River watershed is contained in Section 76 which specifies, "The commission may order the removal of all sewage and other polluting matter or factory waste as a common nuisance from the Charles River and its tributaries below Waltham and from the Charles River Basin; and no sewer, drain or overflow or other outlet for factory or house drainage or for any other drainage shall hereafter be connected with said basin or the river below Waltham without the approval of the commission."

Section 76A through 76D give the Commission the authority to regulate the taking of water and its return to the Charles River Basin by cities and towns for purposes of fire protection and sale to manufacturing establishments for cooling and condensing purposes. The Commission may grant such permits after a public hearing notice to the Department of Public Health and all cities and towns bordering the basin and with the approval of the Department of Public Health. Section 76B states that waters must be returned to the basin in the same good quality and if the use impairs water quality, the Commission shall revoke the permit granted. Section 76D states that no permit to take water from the basin may be granted if such taking substantially affects the maintenance of the water level in the basin at the height required by law. Section 76E gives permission to cities and towns to borrow money for construction of such works required by order of the Commission, subject to the provisions of Section 8 of Chapter 44 of the General Laws.

Chapter 111, Section 175, authorizes the Department of Public Health to protect the Charles River and its tributaries from pollution and provides for the issuing of orders and prosecution by the Attorney General. Section 175 further states that "Nothing herein shall affect any powers of the metropolitan district commission under Section 39 or 76 of Chapter 92."

Division of Marine Fisheries

The authority of the Division of Marine Fisheries to regulate pollution of coastal waters is contained in Chapter 130 of Massachusetts General Laws. Section 22 provides that, if the fisheries are of sufficient value, and after a public hearing, the Director of Marine Fisheries may issue an order to prohibit discharge of any waste, such order to take effect in 10 days after its date. Upon petition of any party aggrieved, filed within six months after date of order, the Superior Court may annul, alter or affirm the order. If the petition is filed within 10 days after date of order, the order does not take effect unless the petition is dismissed or the order is altered or affirmed. A penalty for violations of Section 22 is provided by fine or imprisonment or both.

Section 23 of Chapter 130 provides for fine or imprisonment or both for intentional discharges of other substances than covered by Section 22.

Section 74 gives the Department of Public Health the authority to determine contaminated shellfish areas and to regulate the taking of shellfish therefrom. Section 75 gives the Director of Marine Fisheries the authority to grant permits to certain persons to take shellfish from contaminated areas for purification or for bait purposes only.

Public Law 845, 80th Congress

Because the coastal waters of Massachusetts ebb and flow across the State boundaries of New Hampshire and Rhode Island, the waters are considered to be interstate and as such certain of the loan and assistance provisions of Public Law 845, 80th Congress, have been interpreted to apply to the waters of the Massachusetts Coastal Streams Basin.